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THE NATURAL HISTORY OF THE BRITISH ENTOMOSTRACA.

BY

W. BAIRD, M.D. F.L.S.

ETC.

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"Nihil enim, quod ad Dei immensam gloriam augendum, et ad Naturæ miracula aperiunda faciat, reconditum et absconditum domesticis lustrationibus sepelire debemus."—SCHŒFFER, Apus Pisciformis, p. 21.

"Full Nature swarms with life; one wondrous mass
Of animals, or atoms organized.
. . . . Where the pool
Stands mantled o'er with green, invisible,
Amid the floating verdure millions stray."
THOMSON'S Seasons—Summer.

C. AND J. ADLARD, PRINTERS, BARTHOLOMEW CLOSE.

PREFACE.

In the following pages I have adopted in great part the general arrangement of M. Milne Edwards, and have adhered almost exclusively to the terminology used by him in his classic work on the Crustacea. Some comparative anatomists may object to many of the terms employed as not agreeing with their ideas of Homologies; but I have preferred using terms sanctioned by an authority such as M. Milne Edwards, though perhaps in some cases erroneous, to devising others which might be liable to the charge of still more serious mistakes.

With few exceptions, the figures of the species of the Branchiopoda and Lophyropoda have been drawn from living subjects either by myself or by Mr. Wing, who has devoted much time and labour in illustrating this work. Those of the Caligidæ and Lerneadæ have been done by Mr. Wing exclusively, and from specimens preserved in spirits, most of which have been kindly placed in my hands for the purpose by W. Thompson, Esq., of Belfast, to whose liberality I have much pleasure in bearing testimony, and to whom my best thanks are due for the assistance afforded me, in enabling me to describe these curious and interesting parasitical Crustaceans. My obligations to the other friends who have assisted me with specimens or information will be found gratefully acknowledged in the body of the work.

W. BAIRD.

BAYSWATER;
December 1849.

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NATURAL HISTORY

OF THE

BRITISH ENTOMOSTRACA.

INTRODUCTION.

In this monograph I have retained the name Entomostraca, using it to comprehend all those minute Crustaceans described by Müller under that name, with the various additions which have been made since his time by Latreille, Leach, and others, to that particular group of curious little animals. To none of the Crustacea has so little attention been paid by British naturalists as this division, though there are few deserving of more attentive study. The exceeding minuteness, and the extreme delicacy of structure of the great proportion of them, have perhaps been the causes of this neglect, deterring most naturalists from examining and studying them as they require to be studied—fresh from their native habitats. The difficulty of preserving them obliges the naturalist to seek them in their secret lurking-places, the fresh-water ponds and ditches, and the little pools in the rocks on the sea-shore, where they are chiefly to be found, or on the fishes to which they adhere as parasites, and to study them, as it were, upon the spot, with the aid of his microscope. The external appearance, however, alone of many of these interesting little creatures is enough to excite the curiosity and rouse the attention of the naturalist. Some of them are so like small bivalve shells, that a person ignorant of the *inhabitants* would not fail at first sight to call them so; and the very singular phenomenon of annulose animals being so covered with a shell, has supplied to Müller the name of *Entomostracon*, a term derived from two Greek words signifying "an insect with a shell."*

Previous to the appearance of Müller's work, the few species which were known were arranged under one genus, Monoculus; and they were so called from their possessing, or appearing to possess, only one eye. Schœffer proposed the name *Branchipodes* for them, from their feet possessing branchial appendages; and Müller says he would have preferred this name to that of Monoculus, were it not that several genera wanted these organs. The genera, however, which he mentions, are the Nauplius and Amymone, and the Cythere. The two former are only the imperfect young of the genus Cyclops, and the latter has branchial appendages attached to the jaws. These facts, however, he was not aware of, and therefore he preferred to either of the above names that of *Entomostraca;* a name which has been retained by almost all succeeding authors.

We find several of these little creatures figured by some of the earlier writers on natural history, and more especially by the microscopical observers of the day. Swammerdam, Redi, Leeuwenhoek, Trembley, Baker, Frisch, and Joblot have given figures at least, and some of them descriptions, of several species, while Schœffer has written three separate memoirs upon three different genera, with minute details, and many illustrative figures. Linnæus in 1758 arranged all that were then known under one genus, Monoculus, except two; and Geoffroy, Ström, Goeze, Herbst, and De Geer soon afterwards added to the number. It is to the celebrated Danish naturalist, Otho Fredericus Müller, however, that we are most indebted. To him we owe the collecting the various species already made known into one memoir, the arranging them into distinct genera, many important and exceedingly interesting details regarding them never before made known, and the addition of a great number of new species which that zealous naturalist discovered in the fresh waters and on the sea coast of Denmark and Norway. He may be called the first regular historian of these animals. To him it is we owe a great deal of our knowledge respecting them, and to his eloquent descriptions is perhaps owing the further researches and more detailed histories of succeeding writers. His work on the Entomostraca, published in 1785,* though it contains several errors which have been pointed out by later writers, is still one of the most interesting memoirs in natural history that we are acquainted with.

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* Müller, Entomost., p. 2.

Since the time of Müller much has been done by our continental neighbours to add to our knowledge of these interesting little creatures, and their individual labours we shall take particular notice of as we proceed with this work. It is curious, however, that scarcely any British naturalist, with the exception of Dr. Leach, has paid the least attention to the Entomostraca. His memoirs are scattered over a variety of publications, and a great portion of his attention was directed to the history of the parasitic animals belonging to the group. It surely is not from want of interest belonging to them, that the naturalists of this country have so neglected these curious little animals, for many of them are worthy of all admiration. "The multifarious and complicated structure of their body," says Müller, in his admirable work; "the wonderful agility of their members; the very great fineness of their organs; their singular method of living, and copulating; their living in waters which our cattle and we ourselves are daily drinking; the evils which they may give rise to, and which are seen to be inflicted upon fishes; the advantages, although we are in the greater part ignorant of them, which they nevertheless produce in the economy of nature;* that these things are very worthy of being known scarce any one will doubt. Not to mention their external similitude to shells, and the natural transition which takes place in them, from insects to testaceous animals, who ever knew, before the Cypris was detected, of an insect quadruped? Before the Limulus and Caligus were properly observed, who ever knew of an insect acephalous, or with a head at least scarcely visible? Who ever imagined of a copulation of two males with one female at one time, such as takes place in the famous *Pulex aquaticus?* or of an animal whose head was all eye, as we see in the Polyphemus? These and more wonders are to be met with in the history of the Entomostraca."

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* Entomostraca, seu insecta testacea, quæ in aquis Daniæ et Norvegiæ reperit, descripsit, et Iconibus illustravit Otho Fredericus Müller. Lipsiæ et Havniæ, 1785.

The greater number of these little creatures are furnished with branchiæ, either to their feet or maxillæ, and when noticed in their native habitats may be seen to have them constantly in motion, their action being seldom interrupted. One chief use, therefore, of them in the economy of nature, may be, as Müller says, to ventilate the water day and night; and as they chiefly reside in standing pools, they may thus be of great use in preventing them from becoming soon putrid. As this may be considered one of the benefits conferred by these insects, it may be useful to know the evils to man they may be likely to produce. Though they are most abundant in stagnant water, they yet occur in considerable numbers in the purer sorts of water that serve as our common drink, and may frequently be seen even in the drinking-water of London, Edinburgh, and other large towns; and Müller asserts very gravely, that as we thus drink them alive, and with their eggs, he would not be surprised were we to discover them some day in the human intestines. "The time," he says, "is at hand, when the causes of disease shall not only be sought after in the air, in our method of living, &c., but in the incautious use of waters, often abounding in innumerable animalcules."*

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* "It is the common opinion that it is the Caligi which force the salmon from the sea, up rivers towards the waterfalls."

According to Müller and Straus, the greater number of the Entomostraca, not parasitical, live upon vegetable matter, and not upon animals; and the former, in an experiment he instituted, says,† that in keeping a number of species, such as the *Daphnia pennata* and *longispina*, *Cypris strigata* and *pilosa*, *Lynceus sphericus* and *Cyclops quadricornis*, in the same water from the 24th of July to the 22d of January, during which time the water had evaporated from a depth of five inches to that of one, he frequently subjected small quantities of this water to the microscope, and was never able to discover any animalcules in it upon the most attentive examination, though the intestines of the Entomostraca themselves were seen to be full, sufficiently proving that they had not fasted during that time. This assertion, however, I am much inclined to call in question. The Cyprides particularly seem to be most voraciously carnivorous; and I have invariably found it exceedingly difficult to keep for a length of time any other Entomostraca alive in the same vessel with the larger species of Cypris. In a vessel, in which I have kept full-grown Chirocephali, there were mixed with them many specimens of the *Cypris tristriata*. In a few days the Chirocephali might be seen to become languid in their movements, and assume an unhealthy appearance. The Cyprides had become their deadly enemy. They might be seen ever and anon to fasten themselves to the delicate feet of the poor Chirocephali, and wofully impede their course through the water; and when, either from these annoyances, or from any other cause, they ceased to be able to move with any degree of rapidity, hosts of these little *Carnivora* might be observed to attack them before life was extinct, anticipating as it were their victim's death.

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* Entomost., p. 12.

† Loc. cit., p. 7.

Then, when life had fairly ceased, they rioted upon their flesh, and in a few hours little but the external covering was left.

I have no doubt that most of the Entomostraca are essentially carnivorous, and I have frequently seen specimens of Cypris in their turn, as soon as dead, attacked immediately by quantities of the *Cyclops quadricornis*, who in a few minutes had fastened themselves upon the dead animal, and were so intent upon their prey, that they were scarcely frightened away from it by being touched with the brush. In a short time the Cypris might be seen lying at the bottom of the vessel, the valves of the shell separated and emptied of their contents. Leeuwenhoek and De Geer not only maintain that the *Cyclops quadricornis* lives upon animalcules, but that it even preys upon its own young, a fact which I have also noticed myself. Jurine asserts that the *Cyclops quadricornis* is carnivorous from taste, and only herbivorous from necessity; while the *Daphnia pulex*, he distinctly affirms, lives upon animalcules. Place a few Entomostraca, such, for example, as the Daphniæ, Chirocephali, Lyncei, &c., in a vessel with clear pure water, and only some vegetable matters in it, and they gradually become languid, transparent, and finally die; but mix with this water some which contains numerous Infusoria, and the Entomostraca will then be seen speedily to assume another aspect. They become lively and active, and the opacity of their alimentary canal testifies sufficiently the cause of it. When, indeed, we consider the amazing quantity of animals which swarm in our ponds and ditches, and the deterioration of the surrounding atmosphere which might ensue from the putrefaction of their dead bodies, we see a decided fitness in these Entomostraca being carnivorous, thus helping to prevent the noxious effects of putrid air which might otherwise ensue; whilst they in their turn become a prey to other animals, which no doubt serve their purposes also in the economy of nature. The fresh-water Gammari seem to prey upon them, and the Hydrachnæ are their decided enemies;

"for," says Müller, "they seize hold of them while swimming, by their feet, and daintily suck the life's blood out of their captives with their sharp beaks."[*] "The Hydræ[†] also, and not a few aquatic larvæ, lay snares for them, and many Vorticellæ frequently grievously infest them, for they not only adhere, often in heaps, to the members projecting beyond the shell, but also, nestling themselves within the shell, they overspread the whole body with their own colonies, not a little retarding the motion and agility of their host."[‡] The larva of the *Corethra plumicornis,* known to microscopical observers as the *skeleton larva,* is exceedingly rapacious, more especially of the Daphniæ. They seize their prey with the rapacity of a pike, grasping it with its two strong jaws, and gorging them alive.[§] Pritchard says they are the choice food of a species of Nais, which he calls the *Lurco,* and which devours them in great numbers.[‖] The *Chydorus sphericus* is their especial favorite, and I have repeatedly verified Pritchard's observations, having counted at least ten individuals swallowed alive, and lodged in the different stomachs of this glutton. Those in the first and second stomachs were still alive, while those contained in the inferior ones were more or less partially decomposed. The marine species are also preyed upon by their different enemies; amongst which are the Beroes. "The fact of Beroes feeding upon small Crustacea," says Mr. Paterson, "has been recorded by Fabricius, and at present appears to rest upon his authority. It was interesting to *observe the fact,* which I did without knowing it was previously known. The Crustacea were almost as visible in the transparent body of the Beroe as they had previously been, and very conspicuous by the bright green of their colouring."*

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[*] Entomost. p. 8.

[†] "It would appear that there is something eminently poisonous to animals in the fresh-water Hydræ. 'I have sometimes,' says Baker, 'forced a worm from a polype the instant it has been bitten (at the expense of breaking off the polype's arms), and have always observed it die very soon afterwards, without one single instance of recovery.' To the Entomostraca, however, its touch is not equally fatal, for I have repeatedly seen Cyprides and Daphniæ, entangled in the tentacula and arrested for some considerable time, escape even from the very lips of the mouth and swim about afterwards unharmed—their shell evidently protecting them from the poisonous excretion."—Johnston, Brit. Zooph., 2d edit., p. 131.

[‡] Loc. cit., p. 8. They are frequently covered completely with a small polype, called by M. Reamur "Polypes à bouquet;" for an account of which see Trembley's 'Mémoire sur les Polypes à bouquet, à la suite des découvertes de Needham,' Leyde, 1747; also De Geer, 'Hist. des Ins.,' vii, 437, where he informs us that in April 1742 he first observed this fact, and made a report upon it to the Academy of Sweden, which that learned body inserted in the Memoirs of the Academy in 1747, previously to Mr. Trembley's work being published.

[§] Brightwell, Zool. Journ., v, 396; and t. xix, f. 1.

[‖] Microscop. Cabinet, p. 81.

That the Entomostraca form a considerable portion of the food of fishes has been long observed; and it is very probable that the quality of some of our fresh-water fishes may in some degree depend upon the abundance of this portion of their food. Dr. Parnell informs me that the Lochlevin trout owes its superior sweetness and richness of taste to its food, which consists of small shells and Entomostraca. The colour of the Lochlevin trout, he farther informs me, is redder than the common trout of other localities. When specimens of this fish have been removed from the loch, and conveyed to lakes in other places, the colour remains; but they very soon lose that peculiar delicacy of flavour which distinguishes so remarkably the trout of Lochlevin. The experiment has been repeatedly tried, and always with the same results. The banstickle devours them with great rapidity, and I have seen two or three individuals clear in a single night a large basin swarming with Daphniæ and Cyclops, &c.

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* Letter from Mr. Paterson to Mr. Templeton, in the Memoir on *Anomalocera,* in Trans. Ent. Soc., ii, part i, 39.

SYSTEMATIC ARRANGEMENT.

THE systematic arrangement of the Crustacea has been a matter of considerable discussion amongst naturalists.

Desmarest, in his work,* has given a series of tabular views of the various arrangements which different authors have suggested, from Linnæus to his own time. For a complete view of these we refer the reader to him, and shall only notice a few of the more prominent here, as far as the Entomostraca are concerned.

Linnæus places the Crustacea in the class Insecta, order Aptera, and refers all the species of Entomostraca then known, with the exception of two, to one genus, which he calls Monoculus. Fabricius also places the Crustacea amongst the Insecta; the genus Monoculus, embracing most of the Entomostraca, being placed in his Class VIII, Polygonata, and the genus Limulus in the IXth, Kleistognatha.†

Müller, following his predecessors in arranging the Crustacea amongst the Insecta, places of course the Entomostraca in that class also.‡ He divides them into two great sections, according to the number of eyes, viz. Monoculi and Binoculi. These he subdivides again into Univalves, Bivalves, and Crustacei, according to the form of the shell or covering in which the animal is inclosed.

Latreille§ and Cuvier,‖ in their first published Methods, also placed the Crustacea amongst the Insecta, the former adopting the arrangement of Müller with regard to the Entomostraca, and dividing them into two families, the

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* Consid. gén. sur les Crustacés, 1825.

† Systema Entomologiæ, 1775; Entomologia Systematica, 1793.

‡ Entomostraca, 1785.

§ Précis des Caractères gén. des Insectes, 1796.

‖ Tableau élément. de l'Hist. Nat. des Animaux, 1798.

Monoculi and Binoculi. Brisson, however, in his 'Règne Animal,'* as early as 1756, had formed a distinct class for the Crustacea, of which the Entomostraca formed a part; and Cuvier and Latreille, in their second Methods, and in their subsequent publications, and all succeeding authors, have adopted this arrangement, and have continued to place the Entomostraca with the great family Crustacea, apart from the Insects.

Latreille, in his 'Hist. Nat. gén. et part. des Crust.,' 1802, divides the great class Crustacea into two sub-classes, the Entomostraca and Malacostraca. The Entomostraca he subdivides into two sections—Thecata, those inclosed, 1st, in a shield-shaped, or, 2d, in a bivalve-formed shell or covering, and Gymnota, those in which the body is nearly or entirely naked. The Thecata he divides into four orders, the Xiphosura and Pneumoneura, corresponding nearly to the Binoculi of his first arrangement, and the Phyllopoda and Ostracoda corresponding in part to his Monoculi. The Gymnota he divides into two orders, the Pseudopoda and the Cephalota, which include the remainder of his Monoculi. In his 'Gen. Crust. et Insect.,' 1806, and in his 'Consid. générales,' 1810, he follows the same arrangement; and Leach, in the 'Edinburgh Encyclopædia,' and again in the Supplement to the 'Encyclopædia Britannica,' adopts, in his articles on the Entomostraca, one precisely similar, taking as the basis of his subdivisions the covering or shell in which the animal is contained. In the 'Dict. des Sc. Nat.,' 1819, this naturalist adopts, however, the structure of the feet as the basis of subdivision. He forms four orders: 1st, Pæcilopoda, where the feet in front are formed to walk and lay hold with, and the others for swimming; 2d, Phyllopoda, where the front feet are formed like antennæ, terminated by long setæ, and the others formed for swimming; 3d, Lophyropoda; and, 4th, Branchiopoda, in which all the feet are formed for swimming.

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* Le Règne Animal, divis. en 9 Classes, &c.

Lamarck, in his 'Hist. Anim. sans Vertèb.,' 1818, divides the class Crustacea into two orders, the Heterobranches and Homobranches. The first of these is divided into four sections, Branchiopodes, Isopodes, Amphipodes, and Stomapodes. The second is divided into two, the Macroures and Brachyures. The first section of the first order, viz. the Branchiopoda, includes all Müller's Entomostraca, and all the genera known up to that time, except the genus Nebalia of Leach, which is placed in the first section of the second order, the Macroures.

Latreille, in his last Method, in the 'Règne Animal' of Cuvier, vol. iv, adopts a new arrangement, using for his principal subdivisions the organization of the mouth. He divides the Entomostraca into two orders, the Branchiopoda and Pæcilopoda. The order Branchiopoda contains those genera which have organs proper for mastication, are possessed of branchiæ attached to the feet or jaws, and are for the most part inclosed within a testaceous covering, either in the form of a buckler or that of a bivalve shell. The second order, Pæcilopoda, embraces those which are not provided with organs proper for mastication, and are almost all parasitical, living upon fishes and other aquatic animals. The first order, the Branchiopoda, is divided into two principal sections, the Lophyropa and Phyllopa. The first of these again is subivided into three very natural groups or families, the Carcinoida, Ostracoda, and Cladocera; while the second is subdivided into two, the Ceratophthalma and the Aspidiphora. The Pæcilopoda, on the other hand, is composed of rather heterogeneous materials, and is divided into two families, the Xiphosura and Siphonostoma.*

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* Latreille appears to have been struck with the resemblance which the Lerneæ bear to some of the genera of the Siphonostoma; but as he was then not aware, of what has since been discovered, that the young of the Lerneæ undergo a metamorphosis like that of the Cyclopidæ and Caligidæ, and that the adults have the faculty of changing their skin or moulting, he considered that the absence of these marks established a positive line of demarcation between them and the Entomostraca.

M. Milne Edwards, in his excellent work on the Crustacea,* adopts the organization of the mouth as the basis of his arrangement also. He divides the great class Crustacea into three sub-classes. The first two of these have an apparatus especially provided for laying hold of the substances destined for their food; while the third has no such special organization, their masticatory organs being the same as their organs of locomotion. The first sub-class is that of the Maxillés, or those whose mouth is furnished with organs for mastication. The second is that of the Suçeurs, or those whose mouth is furnished with an apparatus for sucking; and the third is that of the Xyphosuriens, or those whose organs of motion are the same as the organs of mastication, and which differ in many other points also from the first two. The Maxillés he again divides into four legions: 1st, Podophthalmiens, containing the orders Decapodes and Stomapodes; 2d, Edriophthalmes, containing the orders Amphipodes, Isopodes, and Læmipodes; 3d, Branchiopodes, containing the orders Cladocères and Phyllopodes; and, 4th, Entomostracés, containing the orders Ostrapodes and Copépodes. In this arrangement, the last two legions of the Maxillés, the Branchiopodes and Entomostracés, correspond exactly with Latreille's first order, the Branchiopoda, and form a very natural group. The sub-class Suçeurs, he divides into two legions, the Parasites nageurs, containing the orders Siphonostomes and Lernéens; and the Parasites marcheurs, containing the order Aranéiformes. The last sub-class, the Xyphosuriens, contains the single order Xyphosures. In this method we see the Lerneæ constitute a portion of Latreille's Pæcilopoda, into which they were refused admittance by him. They were placed by Cuvier, in his 'Règne Animal,' amongst the Zoophyta, and in general, till within a few years, they were classed by naturalists amongst the Vermes. Desmarest showed the relations they had with the Crustacea, and later observations still, especially those of M. Nordmann, have proved them to belong decidedly to this class. This latter naturalist has pointed out the changes in form they undergo in their progress to maturity, showing them when young to be very nearly of the appearance of the young of the Cyclopidæ, and undergoing like them a series of moultings before they reach the mature state.

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* Hist. Nat. des Crustacés; suites à Buffon, 1834-40.

Another great addition has also of late years been made to the class Crustacea. In consequence of the increased attention that has been paid by naturalists to the habits and formation of the molluscous animals, the Cirripedes which formerly were generally considered to be molluscous, from their being inclosed in a hard shelly case, have now been proved to be crustaceous. The observations of Thompson and Burmeister have demonstrated them to undergo a change of form in early life, being, when first hatched, unattached and floating freely about in the sea, and not attaining their perfect shape till after several moultings have taken place. Having, in addition to these relations, jointed, ciliated limbs also, they approach very closely to the Entomostraca. Amongst them, indeed, they have been introduced by Mr. J. E. Gray, in his arrangement of the Annulosa, in the Synopsis of the British Museum, 1842.

The following table will give a connected view of the arrangement of the British Entomostraca which I propose to adopt.

Sub-Kingdom ANNULOSA.

Class CRUSTACEA—Division ENTOMOSTRACA

Legion First—BRANCHIOPODA.

Order I.—PHYLLOPODA.

Family 1—APODIDÆ, containing one Genus	Apus.
Family 2—NEBALIADÆ, containing one Genus	Nebalia.
Family 3—BRANCHIPODIDÆ, containing two Genera	Chirocephalus. Artemia.

Order II—CLADOCERA.

Family 1—DAPHNIADÆ, containing six Genera	Daphnia. Moina. Bosmina. Macrothrix. Sida. Daphnella.
Family 2—POLYPHEMIDÆ, containing two Genera	Polyphemus. Evadne.
Family 3—LYNCEIDÆ, containing seven Genera	Eurycercus. Chydorus. Camptocercus. Acroperus. Alona. Pleuroxus. Peracantha.

Legion Second—LOPHYROPODA.

Order I—OSTRACODA.

Family 1—CYPRIDIDÆ, containing five Genera	Cypris. Candona. Cythere. Cythereis. Cypridina.

Order II—COPEPODA.

Family 1—CYCLOPIDÆ, containing four Genera	Cyclops. Canthocamptus. Arpacticus. Alteutha.
Family 2—DIAPTOMIDÆ, containing three Genera	Diaptomus. Temora. Anomalocera.
Family 3—CETOCHILIDÆ, containing one Genus	Cetochilus.

* * * *

Placed here provisionally, Genus . . . . . Notodelphys.

Legion Third—PÆCILOPODA.

Order I—SIPHONOSTOMA.

Tribe 1—PELTOCEPHALA.

Family 1—ARGULIDÆ, containing one Genus	Argulus.
Family 2—CALIGIDÆ, containing four Genera	Caligus. Lepeoptheirus. Chalimus. Trebius.
Family 3—PANDARIDÆ, containing two Genera	Dinemoura. Pandarus.
Family 4—CECROPIDÆ, containing two Genera	Cecrops. Læmargus.

Tribe 2—PACHYCEPHALA.

Family 1—ANTHOSOMADÆ, containing one Genus	Anthosoma.
Family 2—ERGASILIDÆ, containing one Genus	Nicothoë.

Order II—LERNEADÆ.

Tribe 1—ANCHORASTOMACEA.

Family 1—CHONDRACANTHIDÆ, containing two Genera	Chondracanthus. Lernentoma.

Tribe 2—ANCHORACARPACEA.

Family 1—LERNEOPODADÆ, containing one Genus	Lerneopoda.
Family 2—ANCHORELLADÆ, containing one Genus	Anchorella.

Tribe 3—ANCHORACERACEA.

Family 1—PENELLADÆ, containing one Genus	Lerneonema.
Family 2—LERNEOCERADÆ, containing two Genera	Lerneocera. Lernea.

ENTOMOSTRACA.[*]

Syn. ENTOMOSTRACA, *Müller,* Entomostraca, 1785.
— *Latreille,* Précis des Caractères génér.; Hist. Nat. gén. et part. des Crustac.; Genera Crustac. et Insectorum; Cuv. Règne Animal.
— *Leach,* Edinburgh Encyclop.; Encyclop. Britann.; Dict. des Sc. Nat., xiv.
— *Duméril,* Zoologie analytique.
— *Risso,* Hist. Nat. des Crust. des Envir. de Nice.; Hist. Nat. de l'Eur. mérid.
— *Desmarest,* Consid. gén. sur les Crust.
— *J. E. Gray,* Synops. of Cont. of Brit. Mus., 1842.
ASPIDOSTRACA or ENTOMOSTRACA, and SIPHONOSTOMA, *Burmeister,* Organization of Trilobites (Ray Society's edit.), p. 34.
MONOCULUS, *Linnæus,* Syst. Nat., 1st edit., 1735; et edit. subseq.; Faun. Suec., 1st edit., 1746.
— *Fabricius,* System. Entomolog.; Entomolog. Systemat.
— *Cuvier,* Tab. élément.
— *Cuvier* et *Duméril,* Anatomie comparée.
— *Geoffroy,* Hist. abrég. des Ins. des Envir. de Paris.
— *Manuel,* Encyclop. méthod.
BRANCHIOPTÈRES and ENTOMOSTRACÉS, *Blainville,* Princ. d'Anat. comp.
LES MONOCLES, *Jurine,* Hist. Nat. des Monoc. des Envir. de Genève.
CRUSTACÉS SESSILIOCLES, *Lamarck,* Syst. Anim. s. Vert., 1801.
BRANCHIOPODES, *Lamarck,* Hist. An. s. Vert., 1st edit., 1818.
— *Bosc,* Man. de l'Hist. Nat. des Crust.

Character.—The Entomostraca may be characterised by their being all aquatic; by their being covered with a shell or carapace, which is of a horny or coriaceous texture, and formed of one or two pieces, in some approaching in appearance to a bivalve shell, in others being in the form of a buckler, which completely or in great part envelopes the body of the animal; by their having branchiæ attached either to the feet or organs of mastication; by their feet being jointed, and all more or less ciliated; and by their undergoing a regular moulting or change of shell as they grow, in some amounting to a species of transformation.

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[*] From *εντομος*, an insect; and *οστραχον*, a shell.

LEGION I—BRANCHIOPODA.*

BRANCHIOPODA (*pars*), *Lamarck*, Hist. An. s. Vert., 1818.
— *Latreille*, Cuv. Règne Anim., 1829.
— *M. Edwards*, Hist. Nat. Crust., 1840.
MONOCULUS, *Linnæus*; *Fabricius*; *Latreille* (minus *Lynceus*), Préc. des Car. gén.

Character.—Mouth furnished with organs fitted for mastication; branchiæ many, attached to the feet; body sometimes naked, but most frequently having an envelope in form of a buckler, in some inclosing only the head and thorax, in others the whole body; feet vary in number, all branchiferous; antennæ two or four, jointed, and generally ciliated; eyes, sometimes two or even three, but frequently only one, or so closely approximated as to appear single. They are all free and unattached, swimming at large in the water.

ORDER I—PHYLLOPODA.†

PHYLLOPODA, *Latreille*, Hist. Nat. Crust., iv, 130, 1802; Gener. Crust. et Ins., i, 14.
— *Leach*, Dict. Sc. Nat., xiv, art. Entomost.
— *M. Edwards*, Hist. Nat. Crust., iii, 351.
— *Desmarest*, Consid. gén. Crust., 357.
— *J. E. Gray*, Synops. Brit. Mus., 1842.
— *Burmeister*, Organiz. of Trilobites, 34.
— *Lucas*, Explor. Sc. de l'Algérie, Crust., 81.
PHYLLOPA, *Latreille*, Cuv. Règne Anim., iv, 171.
BRANCHIOPODES LAMELLIPEDES and BRANCHIOPODES GEANS (in part), *Lamarck*, Hist. An. s. Vert., v.

Character.—Body either naked or having only the head and thorax covered by the carapace; feet numerous, varying from eleven pairs to sixty in number; articulations foliaceous and branchiform, being chiefly adapted for respiration and not for locomotion; eyes, generally two, but sometimes three, in some situated at the extremity of moveable pedicles; antennæ, sometimes only one pair, but usually two, generally small, and not fitted for assisting the animal in swimming; mandibles for the most part without palpi.

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* Βραγχεα, branchiæ or gills; and πους, a foot.
† Φυλλον, a leaf; and πους, a foot.

Family 1—APODIDÆ.

Apus, *M. Edwards,* Hist. Nat. Crust., iii, 356, et auctorum.
Phyllopoda, *Leach,* Edin. Encyclop., vii, art. Crustaceology.
Apodidæ, *Burmeister,* Organization of Trilobites, 34.

Character.—Antennæ one pair, short and styliform; eyes three, sessile; feet, sixty pairs, all branchial; nearly the whole body covered by a large shield-formed carapace; body composed of numerous rings or joints.

Bibliographical History.—The first notice we find taken of any species of the genus Apus, is by Jacob Frisch, in his 'Insecten in Deutschland,' tom. x, published at Berlin, in 1732. He there gives a figure and description of an insect, which he calls "vom Floss-fussigen seewurm mit dem Schild." A specimen, he informs us, was sent to him, well preserved in spirits, from Dantzic, by Klein, who was then secretary of state. In this notice he indicates, though rather vaguely, the use of the word Apus,—a name which has since been given to the genus, and by which it is now known. Soon after this, Klein sent a short notice, with a tolerable figure of the same insect, in a letter to Sir Hans Sloane, which was published in the 'Philosophical Transactions' for 1738. In this letter he says that it was found at Uderwanga, in East Prussia, amongst fresh-water crayfish, and that, from the great number of its legs and their extreme mobility, he was induced to call it the *Scolopendra aquatica scutata.* "As long as the insect lives," he says, "so long does it continue to move its feet with constant and singular facility, withdrawing the extreme part of the body, as it were into a sheath, and again protruding it. I could find amongst authors no trace of any insect of this sort." (p. 152.)

About the same time a number of specimens of the same animal were found in Kent by the Rev. Mr. Littleton Brown, F.R.S., who, in August 1736, sent a specimen, with a letter to Dr. Mortimer, then secretary to the Royal Society, and which is published, along with Klein's letter to Sir Hans Sloane, in the 'Philosophical Transactions' for 1738, No. 447. "I brought it," he says, "from a pond upon Bexby (Bexley?) Common, where great numbers have been observed for these five weeks past. The pond was quite dry, the 24th of June, but upon its being filled with the great thunder-shower, upon the 25th, within two days the pond was observed to swarm with them, by a farmer watering his cows there." (p. 153.)

Linnæus, in his 'Fauna Suecica,' published in 1746, mentions that he had seen a specimen dried of this animal, in London, as early as the year 1728, at the house of a naturalist, who told him that it had been taken in Prussia.

The chief early historiographer, however, of the genus is Schœffer, who in his monograph 'Der Krebsartige Kiefenfuss,' published at Ratisbon in 1756, gives a very long and full account of almost all that was then known concerning it, with well-executed figures of two species, numerous anatomical details, and the progressive development of the animal, from the egg to maturity. His description is very carefully drawn up, and Latreille, in his 'History of the Phyllopoda,' has translated the greater part of it into French, and thus rendered it more accessible to naturalists in this country.

Voschge, in a paper in the 'Naturforscher' for 1783, has given a good many details, and a short but excellent description of the anatomy of the mouth is given by Savigny, in his 'Mémoires sur les Animaux sans Vertèbres,' 1816.

Bosc, Latreille, Desmarest, and Milne Edwards have repeated Schœffer's descriptions and observations in their respective works; and a good account of the circulation of the blood has been given by Gaede* and Berthold.† For the fullest account, however, of the anatomy and physiology of the Apus, since Schœffer's time, we are indebted to Ernest G. Zaddach, who published a thesis at Bonn in 1841, containing many most interesting particulars of the history of this curious animal.‡

Anatomy and Physiology, &c.—The body of the animal is almost completely concealed by the carapace, which is very large, oval-shaped, and covers the head and thorax like a shield. It is rounded anteriorly, and deeply notched at its hinder part. On the back of the carapace, more especially towards the posterior extremity, we see a slight keel, which, as it approaches towards the anterior end, divides right and left, into a sort of fork, indicating there the division into cephalic and thoracic portions. The cephalic portion is the smaller of the two, and it is to this portion alone that the body of the animal is strongly connected; a muscle attaching it just where the first articulation of the thorax takes place, to one point in the centre of its under surface. The thoracic portion covers the thorax and abdomen, without adhering to them at all, except by a fine membrane, which is continued from the point of attachment, and spreads over the whole internal surface of the carapace. The upper surface is convex, while underneath it is concave; its substance is of a horny nature, and not calcareous, is tough and extremely flexible, and possesses considerable elasticity. On the lateral part of each side, (t. I, f. *h*), we see a number of well-marked lines running obliquely, in an arched form, and being reflexed. These, according to Zaddach, are canals, and were pointed out by Gaede and

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* Beiträge zur Anatomie der Insecten, Wiedemann's Zoologisches Magazin, 1817.

† Isis, 1830.

‡ De Apodis cancriformis; Schœff., Anatome et Historia evolutionis. Bonnæ, 1841.

Berthold, to be blood-vessels. Zaddach describes them very particularly, and reckons the number to be nine. The internal plate or membrane which covers the inner surface of the cephalothorax, according to the same author, consists of a soft, spongy, cellular substance, and acts the part of a branchial plate, or respiratory surface. The whole carapace is called by him the "branchia maxima."

The eyes are two in number; large, compound, situated on the upper part of the head, very close to each other, of a reniform shape, projecting, and of a bluish-black colour. They approach each other much nearer at the upper part, leaving a considerable space between them inferiorly. In this space we see a small elevation, smooth, and whitish-coloured, which has been generally described as a third eye. It is simple, however, in its structure, not compound as the other two are, and thus presents a great analogy to the black spot which accompanies the eye in the Lynceidæ, to be afterwards described.

When the *Apus* is laid on its back, and viewed from underneath, we see at the upper part a small portion of the carapace extending across, so as to form a plate, the surface of which is on a level with the edges of the shell. Inserted immediately under the edge of this plate, we see the antennæ (t. I, f. *b*, *c*). These are only one pair, are very short, simple, and consist of two small cylindrical articulations. Between these antennæ is situated the mouth (t. I, f. *b*, *a*). This organ is composed, 1st, of a superior lip, which is very large, firmly attached to the centre of the plate described above, projecting downwards so as partially to cover the mouth, and is of a quadrilateral shape (t. I, f. *b*, *b* 1); 2d, a pair of mandibles (t. I, f. *b*, and f. *a*), each consisting of a thick, short, curved body, terminated by a flat edge, which is furnished with eight or nine strong teeth; 3d, an inferior lip, consisting of two lobes and a longitudinal gutter, and which Savigny describes as a *bifid tongue;* and, 4th, two pairs of jaws (t. I, f. *a*, *a* 1, *a* 2); the first pair consisting of two parts, the chief of which is a plate ciliated and toothed at its extremity; the second pair consisting of two portions also, the internal of which is a short oval plate, ciliated at its edges; and the external longer, cylindrical, and surmounted with a styliform appendage.

The body of the animal, consisting of the thorax and abdomen, is of a nearly cylindrical shape, and is composed of thirty articulations, which are joined to each other by means of a membrane that permits a considerable degree of motion. They diminish gradually in size as they reach the posterior extremity, which projects for some distance beyond the carapace, and are studded all over with short, stout, hooked spines.

The feet are very numerous, amounting to about sixty pairs, and extend from the mouth downwards, lying along the edge of the alimentary canal. The first pair (t. I, f. *d*) are very long compared with the others, are situated immediately behind the mouth, and are ramiform. They are composed of a basilar portion, and several appendages. The basilar part is divided into three joints: the anterior joint gives off two very long, cylindrical, moveable appendages, which consist of numerous small articulations (the one having about sixty and the other about fifty), and a short, flat body ciliated on its edges, which Schœffer describes as a *claw-like production.* The middle joint gives off another numerously articulated cylindrical appendage, formed exactly like the other two, but shorter (having only about thirty articulations), and, like them, possessing a great extent of motion; while the posterior joint gives off a fourth, somewhat similar, but much shorter (having only six articulations), and apparently not possessed of any motion. At the extremity of this joint are several ciliated bodies, which Schœffer calls false teeth* (one being round and possessing very short setæ, the other oval and having about thirty long ones); and underneath we see attached to the middle joint a branchial plate, of a triangular form, with strongly ciliated edges, and another of an oval shape, which Schœffer says is of a red colour when the animal is alive, and is swollen into the form of a small sac or vesicle. This first pair of feet are the principal organs of motion which the animal possesses, and have by many authors been mistaken for and described as the antennæ; and certainly their length and the numerous small articulations of which they consist cause them to resemble very closely the antennæ of the Decapods. They are more properly called the rami. The other pairs of feet are branchial, and do not serve the purpose of locomotion. They are much broader, shorter, and of a lamellar structure, and gradually become smaller and smaller as they descend in the series, till at last they are merely rudimentary. As they serve for respiration, and not for locomotion, their structure is considerably different from that of the pair above described; but though altered to suit their change of function, we may still trace the same structure pervading the whole of them. The chief portion, as seen in the first pair of these branchial feet (t. I, f. *e*) is of much the same form and structure as the basilar portion of the preceding pair, and like it is divided into three joints. The anterior joint gives off two large lanceolate-shaped fingers or claws, strongly dentated on their edges (corresponding with the two long many-articulated appendages of rami), and a small one of similar structure, which Schœffer denominates a *false claw* (corresponding to the flat *claw-like production* of first pair). The middle joint gives off a similar body, also dentated on its edges; and the posterior joint gives off a short, erect body, of a somewhat similar structure (corresponding to the two shorter, many-jointed appendages), while it is terminated by the same ciliated-edged bodies as Schœffer calls, in the first pair, *false teeth*. The triangular branchial plate, with its strongly-ciliated edges, and the vesicular plate or little sac of Schœffer, are also here attached to the first or anterior joint of the basilar portion. The eight succeeding pairs are very much the same as those described above, except that the fingers or claws successively become shorter and broader, while the branchial plates and oval sacs increase in size in the same proportion. These nine pairs of feet are described by Schœffer under the name of *claw-bearing branchial feet.* The tenth pair of the branchial feet differ materially from all the rest (t. I, f. *f*), and as no males have as yet been met with, we can only describe them as they exist in the female. The basilar portion, consisting of three joints, is not distinctly seen, being merely a membranous expansion, although we trace the same number of claws and other bodies described in the preceding feet, but shorter and broader, whilst the triangular branchial plate and oval sac have assumed the appearance of two circular plates, one a little larger than the other, and attached to its fellow by a kind of hinge-joint, which allows them to be folded over upon each other, thus forming a kind of capsule. In place of being transparent and colourless, like the branchial plates in the other feet, these are full of little round spots, like grains, of a bright red colour, and which, when examined by the lens, are seen to be eggs. This pair of feet may therefore be considered as a sort of external ovary,—Schœffer calls them *ovarian feet.* In the centre of the membranous basilar portion we observe a small, reddish spot, surrounded by an elevation in which there is an opening that will admit of a small bristle being introduced. Schœffer considers this to be the situation of the organs of generation. The eleventh (t. I, f. *g*) and succeeding pairs of branchial feet, assume a different appearance from that of the ten preceding. The basilar portion is much shorter, and apparently consists only of one joint. The external finger, or claw, is much larger, and semicircular, but of a membranous structure, and the others, though of the same number, are shorter and broader than the corresponding appendages of the other feet. The oval sac is rather narrower and more elongated, and the branchial plate is more rounded and broader, while on its external edge, instead of the numerous fine setæ which beset it in the preceding, there are only a few (about twelve) longer tubular and plumose setæ. They differ, however, still further in this particular, that in this pair we observe, between the hinder portion of the branchial plate and the external claw, another plate make its appearance, of an ovoid shape, and edged with short setæ. These feet are called by Schœffer the *lamellar branchial feet.* As they succeed each other, we see the external claw become gradually more round-shaped, and the branchial plate lose, more and more, its triangular form, till it becomes quite oblong, while the organs themselves become so small, that they are at last only rudimentary.

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* The figure I have given of this pair of feet, being taken from the organ *in situ*, these parts are not exhibited.

The tail consists of one segment, larger and flatter than any of the immediately preceding ones of the abdomen, which are nearly cylindrical. It is marked by three short, blunt projections at its extremity, and gives off two very long, round appendages, each consisting of an immense number of small articulations; Schœffer counted them, and found each to consist of 480 joints. As the animal can give a degree of motion to these appendages, they may be useful as a sort of rudder, to guide its movements through the water. In the centre of this caudal segment, between these two long appendages, is situate the anus.

The number of articulations, or separate pieces, of which the body of these animals is composed, is extraordinary. Schœffer, with wonderful patience, undertook the task of counting them, and in a table, in which he enumerates them seriatim, reckons the number to be 1,802,604! and Latreille says that we may safely take them to be not less than two millions!!

The Apus inhabits stagnant waters, though they are by no means so commonly to be met with as many of the other kinds of Entomostraca. They appear to be more local, and sometimes disappear from their usual haunts, reappearing some years afterwards in the very same place. "In warm, calm weather," says Schœffer, "they assemble upon the edges of the ponds, and nearly on the surface of the water, but in stormy or cold weather they are no longer to be seen." They can swim as freely upon their back as on their inferior surface, and in both these positions we may see their feet continually in motion, alternately from below upwards, and from right to left, fatiguing the eye to follow them. Indeed their branchial feet seem never at rest, for when the animal no longer uses its rami, but floats idly on the water, these organs are still in rapid motion, causing a sort of whirlpool in the water, and attracting towards their mouth the objects floating about them. Their chief food appears to be the smaller species of Entomostraca, which generally are found in great abundance in the same places, such as Daphniæ and Cyprides, the shells of which latter little creatures they can easily break down by means of their strong mandibles. Schœffer says they perish very quickly after being taken out of the water, or when the ponds dry up. It appears, notwithstanding, that after a pond has been dried up for some time, and suddenly filled anew by heavy rain, in two days these animals will be seen in abundance. The eggs certainly retain their vitality long after being dried, for these little creatures have been known to appear in a ditch that was suddenly filled with water after having been dried up for two or three years. Frogs seem to be their chief enemy, and they are generally to be met with in a more or less mutilated state.

Professor Retzius, at the meeting of the German naturalists at Breslau, in September, 1833, announced that M. Kollar, of Vienna, had discovered the male of the *Apus cancriformis*, but I have not been able to find any detailed description of it.*

Schœffer, Berthold, and Zaddach had considered them to be hermaphrodites; but in all probability the males will be found, as in the case of the Daphniæ, to exist at some particular season of the year, and perhaps in small numbers only. Their method of copulation, therefore, is as yet only conjectural. * That one copulation, however, is sufficient for several generations, as in the case of the Daphniæ, &c., to be hereafter described, has been ascertained.

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* Isis, 1834, p. 680; Froriep's Notizen, 1833, pp. 38, 148; Burmeister, Organ. of Trilobites, Ray Soc. edit., p. 10, 1846.

Schœffer tells us that he has carefully isolated the young as soon as born, and found them to produce eggs, from which a second generation was hatched. He also found that the sun and open air were necessary for this purpose, as he has kept them for a length of time in a warm chamber during winter, without their ever hatching their young; but as soon as warm weather came on, and the vessel which they were in was exposed to the sun and open air, they hatched them in abundance. When taken and placed in a vessel of clear water they may be seen letting their eggs drop from the external ovary to the bottom of the vessel, and in warm weather the young are hatched from the egg in the space of about two or three weeks. † At first they are very different from the parent, undergoing a series of changes before they become fully developed. The egg has two membranes; one external, coriaceous, the other internal, tender, and pellucid. When it is ripe the external membrane opens at the upper part, showing there a small red body, which may speedily be observed to be in motion. This motion increases, attempts seem to be made to burst the internal membrane; and then, after perhaps half a day, it suddenly leaps out from its envelope, a living animal. The egg then falls to the bottom, and loses its red colour, while the young animal commences forthwith its motion to and fro through the water. At first it is of a rosy colour, and an oblong

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* Zaddach imagines that he had discovered the male organ. "It consists," he says, "of a small round body near the mesial line on the dorsal part of the last ring of the body, with a small portion on its apex surrounded by an elevated margin." He had traced a nerve running to it. Should Kollar's discovery be confirmed, this statement must "be attributed," to use Burmeister's words, "to a defective microscopic examination of the organs of generation."

† Zaddach says twenty days.

figure (t. I, f. 2). On the upper part a small black point represents the eyes; and the first pair of feet, or rami, are very large, nearly as long as the animal itself, without articulations, and with only a few hairs at their extremity. The antennæ are large, and project beyond the edge of the shell, having three rather long setæ at their extremity, but the tail is not yet apparent. In fact at this period of their life, those portions of the body which in the adult are the largest, are scarcely visible, whilst those which are then small are now largely developed. The motion of the little creature in the water is more that of leaping than swimming. At the end of twenty-four hours they have become of a white colour, and about this time they undergo the first change of skin. The body then is sharper inferiorly, and there is the appearance of a tail terminating in two points. The rami are divided into three parts, each furnished with several hairs. The branchial feet are also more visible, though still incomplete, and the antennæ, with the three setæ, are even more largely developed still; the eye, too, has become larger. After one or two days more the animal assumes a yellowish colour, and the body is larger and more pointed, while the rami and antennæ have become smaller. The eyes and the branchial feet, on the other hand, have become more remarkable, and the tail begins to show its terminating appendages (t. I, f. 3). They grow gradually larger till about the fourth or fifth day, when they have assumed their proper form, but not their full size. The carapace has now its perfect shape, and upon its head is seen a large green patch, in which may be observed the eyes, of a black colour. The antennæ are still large enough to pass beyond the edge of the buckler, while the rami, though not quite perfect, are now furnished with their ordinary long appendages, but not articulated. The mandibles are visible, of a yellowish colour; the tail and its long appendages are tolerably perfectly formed, and the branchial feet nearly fully developed. At the end of eight or ten days they have acquired considerable size, and go on gradually increasing, till, at the end of three weeks, they have reached the size of one inch in length. The process of moulting, or changing their skin, takes place about twenty times in the space of between two and three months, at which time they seem to have attained their full size. Schœffer says, he never witnessed the process of moulting so as to be able to describe the mechanism, but it no doubt is the same as will be more fully described hereafter, when treating of the Daphniæ.

Schœffer performed several experiments upon the *Apus* to ascertain whether it possessed the faculty of reproducing mutilated members. He found it had not, and that after moulting, the truncated members remained shorn of their fair proportions. It appeared, however, that the excision of one or two of its feet, or part of its rami, produced no bad consequences to the health of the individual so treated.

This family contains only one British genus—*Apus*.

Genus APUS.*

Aπους, *Frisch*, 1732.
APUS, *Schœffer*, *Latreille*, *Bosc*, &c.
MONOCULUS, *Linnæus*, *Fabricius*.
BINOCULUS, *Geoffroy*, *Leach*, Dict. Sc. Nat., xiv, 538.
LIMULUS, *Müller*, *Lamarck*.
TRIOPES, *Schrank*.

Character.—As this family at present contains only one genus, the characters given to it will be sufficient for the genus also.

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* A, privitive; and πους, a foot.

1. Apus cancriformis. Tab. I, figs. 1, 2, 3.

Monoculus cauda biseta, *Linnæus*, Faun. Suec., 344, No. 1181, 1746.
Apus cancriformis, *Schæffer*, Mon. d. Krebsart. Kiefenf., t. 1-5, 1756.
— *Latreille*, Hist. Nat. des Crust., iv, 193, t. 19-27; Gen. Crust. et Ins., ii, 15.
— *Savigny*, Mém. sur les Anim. s. Vertèb., part i, p. 63, t. 7, f. 1.
— *Bosc*, Hist. des Crustac., ii, 243.
— *Leach*, Edinb. Encyc., vii, 384, No. 4.
— *Desmarest*, Consid. gén. sur les Crust., 360, t. 52, f. 1.
— *Guerin*, Iconogr. Règn. Anim. Crust., t. 34, f. 3.
— *M. Edwards*, Hist. Nat. des Crust., iii, 360; Icon. Règne Anim., édit. Crochart, Crustac., t. 75, f. 1.
— *Berthold*, Isis, 1830, t. 7, p. 685.
— *Zaddach*, de Ap. Canc. Anat. et Hist. Evolut.
— *Koch*, Deutsch. Crustac. H. xxxv, t. 4.
Apus montagui, *Leach*, Enc. Brit. Supp., i, 405, t. 20, f. 1-3.
Monoculus apus, *Linnæus*, Syst. Nat., edit. 10th, 1758, i, 635, No. 3; edit. 12th, 1058, No. 3.
— *Gmelin*, Syst. Nat., edit. 13th, 3006, No. 3.
— *Scopoli*, Entomol. Carniol., 413, No. 1138.
— *Leske*, Anfang. der Naturges., 493.
— *Fabricius*, Spec. Insector., i. 372, No. 3; Entomol. Systemat., ii, 488, Supp. 305.
— *Voschge*, Der Naturforsch., x, 60, t. 3, f. 1-10.
Binoculus cauda biseta, *Geoffroy*, Hist. abrég. des Ins., ii, 660, t. 21, f. 4.
Binoculus palustris, *Müller*, Zool. Dan. Prodrom., No. 2407, 1776.
Branchipus cancriformis, *Schæffer*, Element. Entomol., t. 29, f. 1-5.
Limulus palustris, *Müller*, Entomostraca, p. 127.
Limulus cancriformis, *Lamarck*, Hist. An. s. Vert., v, 215.
Triopes palustris, *Schrank*, Faun. Boic., p. 251.
Triops cancriformis, *Oken*, Lehrbuch der Naturg., iii, 398.
Floss-fussigen seewurm, *Frisch*, Insect. in Deutsch., x, t. 1, f. *a-g* (*απους*).
Scolopendra aquatica scutata, *Klein*, Phil. Trans. for 1737, p. 150, t. 1, f. 2 *a-d*.
— *Brown*, Phil. Trans., 1737, p. 153.
Kiefenfuss, *Sulzer*, Die Kennzeich. der Insect., 197, t. 24, f. 153.

Description.—This species is about two inches and a half long, and one inch and a half diameter; of a brownish-yellow colour, clouded with marks of a deeper hue. The edges of the notch in posterior part of carapace are finely toothed, those in the middle and posterior extremity being the strongest and largest. The appendages of the first pair of feet, or rami, are very long; the inferior being frequently two inches in length; the superior, one inch, and curved, and the middle is about one third longer. The caudal segment of body is short, and its two appendages very long, being sometimes more than two inches in length. The segments of abdomen are each studded over with numerous, short, stout, hooked spines, of a dark brown colour, while the long caudal appendages are furnished with numerous short hairs, or setæ.

Hab.—Pond on Bexby (Bexley?) Common, Rev. L. Brown, 1767. Devonshire, Dr. Leach. Bristol, W. Clayfield, Esq. Brit. Mus.

Family 2—NEBALIADÆ.

NEBALIA, *Leach, Desmarest, Latreille, M. Edwards, &c.*

Character.—Antennæ two pairs, large and ramiform; eyes, two, pedunculated; feet, twelve pairs, 8 branchial and 4 natatory; carapace large, inclosing head, thorax, and part of abdomen almost as in a bivalve shell.

Bibliographical History.—Otho Fabricius was the first who described any species of this genus. In his 'Fauna Grœnlandica,' 1780, he mentions finding on the sandy shores in Greenland, chiefly at the mouths of rivers, a small Crustacean, occurring sparingly, which he describes under the name of *Cancer bipes.*

In 1796, Herbst, in his 'Krabben,' vol. ii, p. 111, describes the same animal, placing it among the Gammari, under the name of *Cancer* (*Gammarellus*) *bipes.* Montagu is the next author who has personally noticed the genus, and is the first observer who has described it as British. He read a paper before the Linnean Society in April 1807, which is printed in vol. xi of their 'Transactions;' in which he describes and figures a specimen found by him in Devonshire. He refers it to the Linnean genus Monoculus, under the name of *Monoc. rostratus*, and says it is the largest species of that genus he had ever found in England.

Dr. Leach, in his 'Naturalist's Miscellany,' vol. i, p. 99, published in 1814, describes it more fully than Montagu, and says the species he describes is not uncommon on the south-western and western coasts of England. As he saw that it constituted a very distinct genus from any previously given by modern writers, he formed the genus Nebalia to receive it, and adds, "in a systematic work this genus would hold a very conspicuous and important place, as it is not referable to any family hitherto established." In a paper published soon afterwards by him, in vol. xi of the 'Linnean Transactions,' on the Arrangement of the Crustacea, he assigns its place amongst the Malacostraca, in the order Macroura; in which he is followed by Lamarck, Bosc, and Desmarest, Latreille, Olivier, and Risso; the three latter authors, however, referring the species described to the genus Mysis.

We are indebted to M. Edwards for a more detailed anatomical account of this interesting genus, and its true place in the systematic arrangement. In a paper published by him in the 'Ann. des Sc. Nat., t. xiii, 1828, he shows from its structure, which we shall describe shortly, that it does not belong to the Decapoda Macroura, but in reality must be placed amongst the Branchiopoda; an opinion which he confirms in the 'Ann. des Sc. Nat.,' 2d series, t. iii, 1835, and in his work upon the Crustacea, where he says it constitutes a passage between Mysis and Apus. The details given in these papers with regard to its anatomical structure, and the fact long ago mentioned by the first observer of the genus, O. Fabricius, that it carries its eggs under the body during the winter, and that the young are born in May, appear completely to refute the opinion hazarded by Mr. Thompson, of Cork, that they are most probably only the larvæ of a Cirrhipede.

Anatomy, Physiology, &c.—In the Nebalia the carapace is large, oval-shaped, and covers the whole of the cephalo-thoracic portion of the body, and part also of the abdomen. It is attached only to the head; the thoracic and abdominal segments being quite free and unattached. It is not shield-shaped, as in the Apus, but descends upon the sides, and incloses the portion of the body which it covers, as in a bivalve shell; the antennæ, the natatory feet, a portion of the abdomen, and the tail protruding beyond it. In front, it terminates in a sharp-pointed rostrum or beak, which is slightly curved downwards, and is moveable.

The eyes are two in number, and may be seen projecting from under the anterior edge of the carapace, on each side of the base of the rostrum. They are of considerable size, and of a brown colour, "appearing," says Montagu, "in a strong light, crimson." They are situate upon moveable peduncles, and are formed of a transparent cornea, underneath which are a great number of small crystalline bodies surrounded with a brownish colouring matter.

The antennæ are two pairs, both of them large and ramiform, so that they are fitted to serve for swimming. The first pair are situate immediately below the eyes. They consist of a basilar portion, composed of two strong joints, from the second of which spring an oval ciliated plate, and a slender stalk divided into nine or ten articulations, each articulation having two or three hairs issuing from its base. The second pair spring immediately behind the preceding, and are bent so as to be directed at first obliquely forwards, then downwards and backwards. The basilar portion consists of three stout joints, the last of which sends off a long stalk of about ten articulations, considerably longer than those of the first pair, and having two or three short hairs at the base of each joint.

The organs of the mouth consist of one pair of mandibles and two pairs of jaws. The mandible is composed of a basilar portion, which is short and provided with two large teeth curved inwards, and a long palpiform branch, formed of three joints, of which the last two are much the longest. Behind these mandibles we see a small inferior lip, consisting of two slender scales ciliated on the edges, and united by a peduncle. The first pair of jaws (t. II, f. 1 *a*) are formed of a stout basilar joint, which has on its internal edge a ciliated plate, and gives origin at one extremity to a long filiform stalk, which is directed first forwards, then is curved upwards and backwards, and is prolonged to the extremity of the thorax, between the internal surface of the carapace and the flanks. This stalk is divided into several articulations, each of which is furnished with long hairs. The second pair of jaws have a very large basilar joint, somewhat of a quadrilateral shape, the internal edge of which is divided into several lobes, and strongly ciliated, and the inferior edge gives attachment to two branches, one of which is composed of two ciliated articulations, and the other of only one. Succeeding these organs of the mouth, we next find eight pairs of branchial feet, inclosed entirely within the carapace (t. II, f. 1 *b*). They are of a foliaceous structure, are very slender, placed very close to each other, and are attached to the eight thoracic segments of the body. Each of these branchial feet consist of three portions: 1st, a lamellar piece, forming the internal branch, and occupying the whole length, and which, of considerable size at the base, becomes much narrower at its inferior half; 2d, a large membranous plate, nearly as long as the internal branch, to which it is attached at its upper external part; and, 3d, another membranous plate, placed between the two preceding, and attached also to the upper and external edge of the internal branch.

The thorax is divided into eight slender segments, completely concealed within the carapace; and the abdomen consists also of eight rings, but which are considerably longer and narrower than the preceding. The first four of these are concealed by the carapace, and the other four project beyond it. To the first four we find attached the natatory feet (t. II, f. 1 *c*), consisting of four pairs. These project from beyond the carapace at its inferior posterior portion, and are composed each of an elongated basilar joint, which gives origin to two rather long, strongly-ciliated branches and a very short, simple one. To the fifth and sixth joints we see attached two pairs of what have been described as rudimentary members, and which resemble very much the fulcra or supporters of the external ovaries in the Cyclopidæ. The penultimate joint wants these organs, but the last gives off at its extremity two rather long appendages, forming the tail. These caudal laminæ are smooth on their edges, and are furnished with one long slender filament, and three or four shorter ones, not plumose.

We know very little with regard to the habits of this genus. Otho Fabricius tells us that it carries its eggs under its thorax during the whole winter; that they *begin to hatch* in the month of April, and that the young are *born* in May; they are very lively, he adds, and adhere to the mother, who appears then to be half dead. The adult swims in a prone state, using its hinder feet to propel it through the water. They are not very active. Montagu informs us, that when moving in the water the superior antennæ are in constant motion as well as the abdominal feet, but that the inferior antennæ are usually motionless and brought under the body. They are found, according to Leach, on the south-western and western coasts of England, under stones that lie in the mud, amongst the hollows of the rocks; and Mr. M'Andrew dredged it from a considerable depth amongst the Shetland Isles.

This family contains only one British genus.

Genus—NEBALIA.

NEBALIA, *Leach*, Zool. Miscell., i, 99, 1814; Trans. Linn. Soc., xi, 351.
— *Thompson*, Zool. Research., No. 3, 83.
— *Desmarest*, Cons. gén. Crust., 243.
— *Latreille*, Cuv. Règne Anim., iv, 153.
— *M. Edwards*, Hist. Nat. Crust., iii, 353; Ann. Sc. Nat., xiii, 297; 2d series, iii, 309.
— *Risso*, Hist. Nat. Eur. mérid., v, 84.
— *Bosc*, Man. Hist. Nat. Crust., ii.
— *Lamarck*, An. s. Vertèb., vi.
CANCER, *O. Fabricius*, Faun. Grœnland., 246, No. 223.
— *Herbst*, Krabben, ii, 111.
MONOCULUS, *Montagu*, Trans. Linn. Soc., xi, 14.
MYSIS, *Olivier*.

As this is the only genus as yet belonging to the family, the characters above given will suffice for both.

1. NEBALIA BIPES. Tab. II, f. 1.

CANCER BIPES, *O. Fabricius*, Faun. Grœnland., 246, No. 223, 1780.
CANCER (GAMMARELLUS) BIPES, *Herbst*, Krabben, ii, 111, No. 56, t. 34, f. 7, 1796.
NEBALIA HERBSTII, *Leach*, Zool. Miscell., i, 100, t. 44, 1814; Trans. Linn. Soc., xi, 351.
— *Desmarest*, Cons. gén. Crust., 243.
— *Thompson*, Zool. Research., iii, t. 11, f. 1.
NEBALIA GLABRA, *Lamarck*, An. s. Vert., v, 345.
— *Bosc*, Man. Hist. Crust., ii, 83.
NEBALIA CILIATA, *Lamarck*, An. s. Vert., v. 345.
— *Bosc*, Man. Hist. Nat. Crust., ii, 84, t. 13, bis, f. 3.
NEBALIA MONTAGUI, *Thompson*, Zool. Research., iii, t. 11, f. 2.
MONOCULUS ROSTRATUS, *Montagu*, Trans. Linn. Soc., xi, 14, t. 2, f. 5, 1807.

Character.—Body ovate, of a pale yellow colour, with a darker longitudinal line along each side; antennæ long, the inferior pair as long as the body, and setiferous; beak of carapace sharp-pointed and moveable; natatorial feet of moderate length, and setiferous; caudal appendages rather long, and furnished at extremity with one long slender, and three or four short setæ, not plumose. Length, three eighths of an inch.

Montagu describes his species as possessing only three pairs of natatorial feet, and in his figure represents them, as well as the antennæ and caudal appendages, as very hairy.

Leach describes his as having five pairs of natatorial feet; and in his figure represents the antennæ and caudal appendages as without setæ

The figures given by Fabricius and Herbst represent their species also as possessed of five natatorial feet, and the antennæ and caudal appendages destitute of setæ.

Lamarck, taking these as specific differences, makes two species. The species of Fabricius and Herbst he calls *N. glabra,* while that of Montagu and Leach he calls *N. ciliata.* In this he is followed by Bosc; but Leach himself, Desmarest, and others, consider them as identical.

It is evident that both Leach and Montagu have mistaken the true number of natatorial feet, which have more recently been shown by M. Edwards to be four pairs in all the known species of this genus. Similar mistakes are frequently made by the earlier observers of the minute Entomostraca; and when we consider the difference in the powers of the microscopes made use of by different observers, we can easily account for the discrepancies in the several figures with regard to the amount of pilosity in the various parts represented. The figures given by M. Edwards, for instance, of the species which he describes under the name of *N. Geoffroyi*,. do not show much pilosity, but the enlarged figures of the details represent no small array of setæ in all the organs. I have no doubt, therefore, that the species described by Montagu and Leach, as found in England, are identical; and it is equally clear that they are identical with that described and figured by Fabricius, and reproduced by Herbst.

The specimens collected by Mr. Thompson, in Clifden and Roundstone Bays, in the west of Ireland, in July 1840, and which were kindly lent me by that gentleman for examination, agree remarkably well (with the exception of the number of feet, which were four pairs) with the figure of Fabricius. As that naturalist was the first observer of the species, it is but justice to restore to it the specific name given by him, and call it *Nebalia bipes*. As the name of *Herbstii* was given it by Leach, evidently from a mistaken notion that Herbst was the first observer, and as that author in reality only reproduces in his work the figure previously given by Fabricius, it is still further a matter of justice, and in accordance with the law of priority, to restore its original designation.

Hab.—Coast of Devonshire, Montagu; south-western and western coasts of England, Leach (British Museum); Clifden and Roundstone Bays, west coast of Ireland, W. Thompson, Esq., 1840; Shetland Isles, R. M'Andrew, Esq., 1847.

Family 3—BRANCHIPODIDÆ.

BRANCHIPIENS, *M. Edwards*, Hist. Nat. des Crust., iii, 364.
BRANCHIOPODA, *Leach*, Dict. des Sc. Nat., xiv.
BRANCHIPUSIDÆ, *Baird*, Trans. Berw. Nat. Club, 1845.
BRANCHIPIDÆ, *Burmeister*, Organiz. of Trilobites, Ray Soc. edit., p. 34.

Character.—Body not inclosed within or covered by a carapace of any kind. Two pairs of antennæ, the inferior being prehensile in male; eyes two, pedunculated; feet 11 pairs; all branchial.

This family contains two British genera, Chirocephalus and Artemia, closely allied to each other.

1. CHIROCEPHALUS.—Tail formed of two well-developed plates; inferior antennæ or cephalic horns, in male, cylindrical, and provided at their base with fan-shaped and digitiform appendages.

2. ARTEMIA.—Caudal segment of body, simply bilobed,

and not divided into two plates. No appendages at the base of cephalic horns.

1—CHIROCEPHALUS.*

CHIROCEPHALUS, *Prevost*, 1803; *Thompson.*
BRANCHIPUS, *M. Edwards, Fischer, Latreille, Desmarest, Guerin, Lamarck.*
INO, *Schrank*, 1803; *Oken.*
CANCER, *Shaw.*

Character.—Abdomen large, consisting of nine divisions, and terminated by two well-developed caudal plates or lamellar appendages; cephalic horns, of a cylindrical shape, and furnished with fan-shaped and digitiform appendages in the male.

Bibliographical History.—A figure of the Chirocephalus was given by Petiver, in his ‘Gazophylacion Naturæ,’ as early as 1709. He mentions it as a native of England, but merely describes it shortly, as “Squilla lacustris minima, dorso natante.” It was afterwards described at greater length, as British, by Edward King, F.R.S., who read, before the Royal Society, a short description of “a very remarkable aquatic insect, found in a ditch of standing water, near Norwich, in the spring of the year 1762,” and which is published in the ‘Philos. Trans.’ for 1767. “They were discovered,” he says, “by a poor man now dead, whose genius was very extraordinary, and much superior to what is usually found in his rank. He was indefatigable in his searches after everything curious, and without ever having had any advantages of education, had acquired a degree of knowledge by no means contemptible. . . . In the ditch from which they were taken,” he continues, “there were a vast multitude of the same kind, though they have not been found in any other place that I know of. From their being prolific in this state,

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* From χειρ, a hand; and κεφαλον, head.

I suspect it to be their only one, and that they are merely aquatic, and never turn to flies, as many insects found in water do." (p. 72.)

Linnæus had, long previously to this, in his 'Fauna Suecica,' 1746, noticed an animal which may, perhaps, be the same as this. He inserts it at the end of the volume, as if in doubt where to place it, and indeed describes it as a larva. He asks, "An larva Ephemeræ?" but at the same time particularly mentions the *female* as possessing a small, yellow, shining globule, adhering to the abdomen, and which, he says, is perhaps the ovary, ready, as soon as the metamorphose is completed, to become eggs.

A few years after this, Schœffer, while studying the Entomostraca, discovered, in a pool of water near Ratisbon, a number of specimens of an "aquatic insect," very similar to the species found in England. He published a long description of it in 1752, under the name of *Apus pisciformis*, which he afterwards, in his 'Element. Entomol.,' changed to *Branchipus pisciformis*. Schœffer appears to have dissected it very carefully, and gives figures of various parts, as observed by the microscope; but neither in his description nor his figures does he take the slightest notice of the peculiar complicated apparatus attached to the head, which characterises so strongly the genus Chirocephalus, and which, though roughly executed, is decidedly exhibited in the figures given by King. Linnæus, in the meantime, having ascertained that his opinion, as to the insect which he mentioned in the 'Fauna Suecica' being a larva, was erroneous, described it, in the tenth edition of the 'Systema Naturæ,' as a Crustacean, under the name of *Cancer stagnalis*. His description is so short that it is impossible now to ascertain whether the animal he mentions possessed this peculiar apparatus or not; but Dr. Shaw found it again in England, and published a lengthened notice of it in the first volume of the 'Linnean Transactions' for 1791. He does not state the locality where it was found, but he describes and figures with considerable accuracy the peculiar apparatus attached to the head, which he considered part of the mouth. He carefully watched also the process of hatching the young from the egg, and was the first to characterise and figure some of the changes they undergo before reaching maturity. He calls it by the Linnean name, *Cancer stagnalis*, and confounds it with the animal described by Schœffer.

This confusion is kept up by Bosc and Latreille, who take the details almost literally as given by Schœffer, but who quote the descriptions of King and Shaw, as synonyms for the same species as mentioned by him. Similar confusion pervades the writings of all authors upon this subject till the time when M. Benedict Prevost published an excellent paper upon the genus, in the 'Journal de Physique' for 1803, giving a very minute anatomical description of the animal, with a great many details concerning its habits and development, from the egg to maturity. This paper having attracted the attention of M. Jurine, of Geneva, then busily engaged in studying the Entomostraca of that neighbourhood, he wrote to M. Prevost, requesting him to send some of the ova of the little creature he had described so particularly. His request was immediately complied with, and M. Prevost sent from Montauban to Geneva a quantity of ova, wrapped up in moist paper. These, though they were four days on the road, M. Jurine with great care hatched, and succeeded in bringing them to maturity. Having submitted the animals so reared to frequent examinations and careful study, he was enabled to verify all M. Prevost's facts and observations, while his accomplished daughter, Mademoiselle Jurine, faithfully portrayed them, as seen by the microscope. These drawings having been placed at the disposal of Prevost, and his original paper having received from his own hands some emendations and corrections, were all published, in 1820, at the end of M. Jurine's work on the 'Monocles qui se trouvent à Genève;' and the information given is so full and precise, that little has been left to be added to the history of this curious animal. He does not attempt, however, to clear up the obscurity in which the species described by Schœffer seems to rest. Fischer de Waldheim, however, and Mr. J. V. Thompson seem to have published in the same year (1834) a short attempt to do so; the former making two distinct species, the first as described by Schœffer, the other by Prevost; while the latter makes the species described by Schœffer as the type of the genus Branchipus, and the one by Prevost as the type of the Chirocephalus.

If Schœffer's details and figures are to be relied upon, the species which he at such length describes does not appear to have been ever seen, except by himself at Ratisbon; for all the continental writers who follow him merely quote his description and figures. While the species which have been noticed by observers in France and Switzerland, such as Duchésne, in the 'Manuel du Naturaliste,' Prevost, and Jurine, and by King, Shaw, &c., in England, are all clearly referable to the genus Chirocephalus.

Anatomy and Physiology, &c.—The Chirocephalus is of a slender, elongate form, the body being perfectly naked and uncovered by shield or carapace of any description. We can readily distinguish a head, thorax, and abdomen, all well developed.

The head consists of two segments, the inferior of which is more slender than the superior, and is generally described as the neck. Attached to this head we distinguish the antennæ, eyes, and mouth.

The antennæ we shall find, in many of the Entomostraca, differ in the male and female.* In the Chirocephalus the difference is very striking. They are two pairs in number. In the male, the superior (t. IV, f. A) are slender and filiform, straight, extremely flexible, and composed of a very great number of exceedingly minute articulations, scarcely perceptible even with the aid of a microscope,

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* Vide description of Cyclops and of Daphnia.

and terminated by several very fine short setæ. They are about the length of the head, take their origin from its upper surface, a little above the root of the pedicle of the eyes, and are directed upwards. They are jointed at the lower third of their length, which adds to their mobility, and are frequently put into motion by the animal. The inferior pair (t. IV, f. B) are very remarkable, and have been described by different authors as organs totally different from antennæ. Schœffer, who describes them in the Branchipus, calls them tentacula, and Latreille a sort of mandible; while Prevost and Jurine, who describe them with their complicated attached apparatus, call them hands. Their position, however, upon the anterior segment of the head, seems, says M. Edwards, to determine their true nature, though certainly at first sight their conformation appears different from what we usually see in these organs. They are essentially prehensile organs, and consist chiefly of two large appendages which occupy the fore part of the head, and are curved downwards towards the thorax. They are articulated about the middle of their length, the first joint being very large and fleshy, and having a short moveable conical appendage on its external edge; the second being curved, cylindrical, somewhat flattened at its extremity, and having a strongly-toothed process at its base.

Arising from the base of the first joint of each of these appendages, we see another organ of a singular conformation (t. IV, f. c and c*). It was first distinctly pointed out by Shaw ,and has since that been also described by Prevost. By the former it is called the trunk, and by the latter the second finger. They each consist of a long, flat, curved, very flexible body, composed of numerous short articulations, strongly toothed at its edges, and evidently consisting of numerous muscular fibres. On the outward edge of each, near the base, there are given off four rather long and very flexible appendages, strongly toothed on their internal edge near the extremity, and a large membranous triangular-shaped body which, when extended

(t. IV, f. D), can nearly cover the others, toothed, and, as it were, vandyked round its external edge, and folding up like a fan when the animal does not use it. These organs are generally carried by the animal rolled round under the head, and, as Shaw says, somewhat in the same manner as a butterfly carries its proboscis, their situation being externally visible only by a protuberance. During copulation, however, they become extended in a straight line, and when so, they nearly equal in length the main part of this curiously-formed organ.* These prehensile inferior antennæ are used by the animal to seize hold of and retain the female in copulation, and seem exceedingly well adapted for the purpose. In the female (t. IV, f. E) they are differently and much more simply constructed, being merely in the form of two short, stout, and somewhat sharp-pointed and flexible horn-like bodies, projecting forwards when the animal is in the water, with a slight curve downwards, and not provided with any of the appendages described above as belonging to the male. The superior antennæ, however, are precisely similar to those of the male.

The eyes (t. IV, f. F *a*) are very large, black, convex, oval-shaped, and composed of an immense number of small lenses, covered with a transparent cuticle. They are situated at the sides of the head, and are fixed upon considerable-sized peduncles, which take their origin from nearly the same part of the head as the antennæ, and which are conical-shaped and moveable, the animal having them almost always in quick motion in all directions.† In the centre, between these organs and on the front part of the head, we see a small, black, smooth spot, of a somewhat triangular shape, and which is generally described as a third sessile, simple eye. It appears to be merely the mark remaining of what was the eye in the young state, and will be more particularly mentioned when describing the young animal and its transformations.

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* Prevost finds much fault with Shaw's figure of this curious antenna, especially with this proboscis-shaped portion of it. When fully extended, however, as when compressed between two pieces of glass, the figure given by Shaw, though ill proportioned and roughly executed, is a very fair representation of it. Jurine's figures, though more elegantly executed, exhibit it such as I have seen it in a very young male only partially extended. Shaw, however, does not figure nor describe the membrane connected with the four appendages, and erroneously represents only *three* of these in his figure.

† Burmeister has described the structure of the eye of the Branchipus

The mouth is situated in the inferior surface of the posterior cephalic segment, and consists of a lip, one pair of mandibles, and two pairs of jaws.

The lip (t. IV, f. G) is large, projecting, curved backwards, and is prolonged below the other parts of the mouth. It is articulated, and has considerable motion, enlarging and contracting alternately. It is the "soupape" of Prevost and Jurine.

The mandibles (t. IV, f. H) are also large, embracing about four fifths of the circumference of the segment of the head, to which they are attached, somewhat curved, having the inner extremity large, obtuse, black, and furnished at its edge with numerous very small teeth, so fine as scarcely to be distinguished with the microscope, while the other extremity is smaller, and terminates in a sharp point.

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at greater length. "It consists," he says, "of four successive layers of different kinds. The external layer is a smooth, homogeneous, transparent cornea. Beneath it lies a facetted membrane, which, seated in a clear substance, contains rather darker, firmer, circular apertures, of equal size, and regularly distributed in such a manner that every ring is surrounded by six others, at equal distances from each other. The third layer of the eye consists of egg-shaped, transparent, very hard lenses, each of which is situated behind one of the little window-like apertures described, resting upon the surface of the latter with its flatter extremity, and raising this a little with that convex surface. The fourth layer consists of an oblong, club-shaped, crystalline body, which encircles with its upper thicker end the more pointed end of the egg-shaped lens, and is surrounded by a delicate membrane. A continuation of this membrane also overspreads the lens, and attaches itself to the thickened margin of the little aperture before each lens. Behind the crystalline body there then follows the dark pigment as the principal mass of the whole eye, through which the fibres of the optic nerves extend themselves to the respective ocelli, resting on the basis of the crystalline body, and the lenses, and through these sheaths likewise attach themselves to the facetted second membrane."—Organization of Trilobites (Ray Soc. edit.), p. 19.

The jaws (t. V, f. A) consist each of a small lamellar somewhat triangular body, furnished at its edge with a number of long bristles, about twenty-four in number. They are the "barbillons" of the mandibles, of Prevost and Jurine.

The thorax is cylindrical, and is composed of eleven segments, each united to its fellow by a membrane, which allows of a considerable degree of motion, permitting the animal to curve its body in form of a circle, a position it always seems to take when out of the water. The first segment is the largest, the others gradually diminishing in size as they descend.

To each of these segments is attached a pair of branchial feet (t. V, f. B.) These are broad and foliaceous, and consist of three articulations. The first is the largest, and has on its lower edge a semicircular branchial plate, giving off about thirty or forty beautifully plumose hairs; the second gives off, on its inner edge, three square-shaped projections, each of which sends off several long hairs; and the third is long and narrow, and gives off numerous setæ, also plumose, and of considerable length. From the first joint, near its juncture with the second, there arises a vesicle or flat body, which is studded over with minute points, but has no setæ attached to it. It is of a denser structure than the other portions. The first pair of feet are the smallest, the others gradually increasing in size till they reach the tenth pair, the eleventh being considerably smaller than those preceding, though still larger than the first.

The abdomen is composed of nine segments, the two first of which are the largest, the rest gradually diminishing in size as they descend to the tail. This consists of two lamellar appendages of considerable size, and beset round the edges with numerous beautifully plumose setæ.

Between the first and second segment of the abdomen we see in the male the organs of generation, and in the female the external ovary or oviferous pouch. The male organ appears to be double or bifid, cylindrical, transparent, and, according to Schœffer, composed of two joints. The oviferous sac, or external ovary of the female, is very large, and distinctly visible. It is conical, and the point opens like the beak of a bird, to allow the eggs to escape. Prevost, however, informs us that the vulva is not situated here, but what appears singular, is placed at the extremity of the tail on each side of the anus, being double or bifid, to correspond with the double penis of the male.

The heart or dorsal vessel commences near the head, and terminates at the end of the penultimate ring of the body. It is brilliant, quite diaphanous, and consists of a series of small hearts, as Prevost calls them, to the number of about eighteen or nineteen, all placed end to end, and all moving together. It was pointed out by Schœffer in the Branchipus.

The digestive canal, commencing at the mouth, at first mounts up a little, then curves downwards, and runs along the body, terminating in the anus, between the caudal segments.

The Chirocephalus is found in stagnant water: very often in the ditches and deep cart-ruts on the edges of woods and plantations.

It is rarely to be met with in this country, compared with the Daphniæ, and many other Entomostraca: the only place near London where I have met with it being on Blackheath. They swim upon their back, and in fine warm weather, when the sun is not too strong, they may be seen balancing themselves, as it were, near the surface by means of their branchial feet, which are in constant motion. On the least disturbance, however, they strike the water rapidly with their tail from right to left, and dart away like a fish, and hasten to conceal themselves by diving into the soft mud, or amongst the weeds at the bottom of the pool. They are nearly transparent, and are of a very light reddish colour, with a slight tinge of blue on some parts. "When placed in a glass of clear water," says Prevost, "the elegance of its form, the ease and softness of its movements, its silvery transparency, or its brilliant colours, its large black eyes, the small spot which it carries on its head, the crown of the male, are a beautiful sight, which the most indifferent observer cannot see without pleasure." It is certainly the most beautiful and elegant of all the Entomostraca. The male is especially beautiful. The uninterrupted undulatory, wavy motion of its graceful branchial feet, slightly tinged as they are with a light reddish hue, the brilliant mixture of transparent bluish green and bright red of its prehensile antennæ, and its bright red tail, with the beautifully plumose setæ springing from it, render it really exceedingly attractive to the view.

The undulatory motion of its branchial feet serves another purpose in addition to that of keeping the animal suspended in the water. The thorax or body of the animal has been described, when floating on its back, as like the cavity of a little boat, the feet representing the oars. When these are in motion, they cause the water contained in this boat-like cavity to be compressed, and to mount up as along a canal, carrying in the current the particles destined for its food towards the mouth. It seems to be constantly, when in this position, employed in swallowing and digesting its food, its masticatory organs being in perpetual motion.

Shaw imagined this little creature to be a fierce and voracious beast of prey, but it is not so; he was misled in so thinking, by not understanding the true use of its prehensile antennæ. These he imagined were organs for seizing its victims and crushing them to death; though he candidly admits that he never saw them attack other animals, and even says that he has seen them succumb to the assaults of the Cypris. According to Prevost, they live upon dead animal or vegetable matter; but they have apparently little taste, for they swallow every sort of thing that comes in their way, however hurtful it may be. Schœffer says that he found great difficulty in keeping the Branchipus alive after having been taken out of the water in which they were found, and also says that they are incapable of bearing any degree of cold. Jurine, however, found no difficulty in hatching the ova of the Chirocephalus sent to him by Prevost, and keeping the animals so hatched till they reached maturity; and Shaw distinctly asserts that he has found them in this country in shallow pools, in the months of December and January, even after pretty sharp frosts, as lively almost as in spring or summer. I have always found them in the months of October, November, and December, and even after frosts of short continuance, though of considerable severity. In general they have been very short-lived after being removed from their native habitat, but I have been able to hatch the young and watch their progress to maturity. Though they do not appear destructive to other animals, they fall an easy prey themselves to various enemies. Frogs, salamanders, the larvæ of the Dytisci, the Cyprides, and other such inhabitants of the water, kill them in vast numbers, and they seem, besides, according to Prevost, to be specially infested by a species of Vorticella, or wheel animalcule, which attaches itself to the body of the animal in great numbers, and would very soon, were it not for their moulting frequently, completely destroy it. I have found them very liable to a peculiar disease, which seems very frequently to terminate fatally. It attacks their body near the external ovary, the lower part of the abdomen, &c., and the branchial feet are not exempt from it. It consists of a white growth, composed of a fatty sort of substance, and when once this appears, the poor animal almost always soon after dies.

When copulation takes place, the male glides underneath the female, and seizing her firmly with his powerful prehensile antennæ, forces her to bend her tail towards his abdomen, where the male organs lie. The ova appear at first as small, white, spherical bodies lying in the internal ovary, which stretches along the abdomen, and then passing from it into the external ovary already described. When the proper time arrives, the mother deposits these ova loose in the water, the ovary opening at the point, and the eggs being thrown out by a sudden jerk, to the number of ten or twelve, very rapidly. The whole process of laying lasts several hours, sometimes, according to Prevost, for a whole day, and the number of ova excluded vary from 1 to 400. At first the egg is yellowish, spherical (t. V, f. 1), and inclosed in a thick, hard envelope, beset all round with short setæ, but when it has been for a short time exposed to the action of the air and water, it assumes an irregular hexagonal figure, and a greenish hue. In about a fortnight or so, the egg is hatched, and the young one issues forth, but very unlike its parent. It consists of two nearly equal oval portions, head and body.

The cephalic division possesses two very large antennæ, and two pairs of largely-developed natatory feet, the anterior much larger than the others, and both furnished with a considerable number of stiff setæ springing from their under edge.

The eye is sessile, not compound, a single black spot, situate in the middle of the fore part of the head, between the antennæ. There is at this time no appearance of the pedunculated eyes, and it would seem that these require considerable elaboration to come to perfection. In the adult state, upon dissection we see these eyes furnished with well-developed muscles and nerves, while there is no trace remaining of any muscles, or vessels of any kind, going to the black spot, the mark of which then still remains.

In a short time after birth (longer or shorter according to the temperature), the young creature throws off its skin, or moults, and we then see a distinct appearance of the two lateral eyes; the body becomes much increased in size, is divided into segments, and a series of knobs or projections may be observed along its edges, destined to become the feet, while at its extremity we see a notch, with a filament from either side, being an approach to the formation of the tail. It soon moults a second time, and we then see the buds, as it were, of the first three pairs of feet, which are not yet moveable, and four pairs of small knobs or projections, the rudiments of as many other feet. After moulting for the third time, the first two pairs of feet have become moveable and foliaceous, and we can distinguish seven pairs of rudimentary feet. The eyes have become somewhat pedunculated, and the body more elongated. It continues to moult frequently, and at short intervals, and we can trace the conformation gradually approaching more and more to that of the adult. The branchial feet become, after each time, more developed, the eyes more perfect, while the large natatory feet, which are so large and conspicuous when first born, are gradually converted into the prehensile antennæ in the male, and the cephalic horns of the female.

In January 1849, I had several specimens of female Chirocephalus, which had been taken at Blackheath on the 25th of December previous. These deposited their eggs in the vessel in which they were kept, and though the mothers died in about a fortnight after they were taken, the ova were matured in the vessel, and the young hatched. Upon submitting a mature ovum to inspection under the microscope, I found the young animal inclosed within a pure, transparent envelope, which again had evidently had an external thicker and opaque coat over it. This was more than half detached (t. V, f. 2). A few hours afterwards, I found that this thick external covering was completely separated, and the young was then merely inclosed in the transparent case. Twelve hours afterwards it was still within its envelope, but it completely filled it lengthwise. It was balloon-shaped (t. V, f. 3), perfectly transparent, and colourless, and the young animal pushed frequently its head against the top of its case, as if trying to burst it open. It could turn itself round, however, from one side to another. In twenty-four hours more I found the young animal just launched from its prison into the world. Two or three hours after its birth I submitted it to inspection through the microscope. At that time, 6th February, five p. m., it resembled t. V, f. 4. The body was composed of two oval portions, of nearly equal size; the upper having attached to it a pair of long antennæ, and two large natatory feet; the inferior having no appearance of legs or tail, but being merely notched at the extremity.

On the 7th of February, at six p. m., or about twenty-four hours after birth, I found the abdomen had become more elongated, being then longer than the thorax, and had four slight protuberances, or knobs, on each side, at its upper part, the uppermost being the largest. The notched extremity had two short, sharp setæ. The natatory feet were the same, but the whole animal had grown, and the eyes were visible, in shape of a black spot on each side of the head.

On the 8th, at six p. m., or forty-eight hours after birth, the thorax had become more square-shaped, and elongated, and the lateral eyes were larger. The knobs on each side of abdomen were six in number, the upper being the largest, and having a short seta making its appearance at its extremity. The upper part of the abdomen was more bulging out at the sides, where the knobs appear, and the whole animal was considerably elongated.

On the 9th, at six p. m., or seventy-two hours after birth, I found the animal had grown in length. The knobs were increased to eight, the three uppermost with a seta each at its extremity. The alimentary canal was very large, extending from a short distance from under the central eye to the tail, taking up nearly half the breadth of the whole body as it passes down. At the upper part it forms a fork, with two short and blunt divisions. The antennæ, and upper pair of natatory feet, continued much the same, but the lower pair had become smaller in proportion to the size of the animal, and distinctly articulated; the basal joint being large and fleshy. The caudal setæ were considerably longer. The central eye was rather smaller, and the lateral eyes had become areolar.

On the 10th, at six p. m., ninety-six hours after birth, it had become somewhat increased in length. The knobs were nine in number, the four uppermost being free from the body, and setiferous at the extremity, and much increased in length. The antennæ had diminished in length in proportion to the body.

On the 11th, seven p. m., about 120 hours after birth, I found it had undergone scarcely any change in appearance.

On the 12th, 144 hours after birth, I found it enveloped in a covering of filmy, slimy stuff, which had been floating about in the water. It had, notwithstanding, gone on increasing in development. The knobs were eleven in number; the first six pairs free, and the three or four superior pairs distinctly lamellar. The lateral eyes had become distinctly pedicled, and on each side of the median eye there was a slight projection or knob. I was unfortunately prevented carrying my observations further.

The female begins to lay before she has attained her full size, and lays several times during the season. Each time the ova are transmitted from the internal to the external ovary, the animal throws off its skin.

1. CHIROCEPHALUS DIAPHANUS. Tab. III, figs. 1, 2.

CHIROCEPHALUS DIAPHANUS, *Prevost*, Journ. de Phys., 1803, lvii, 37, t. 1, f. 1-3.
— *Jurine*, Hist. Monoc., 201, t. 20-22.
BRANCHIPUS PREVOSTII, *Fischer*, Bull. Soc. Imp. Nat. Moscou, vii, 1834.
CHIROCEPHALUS PREVOSTII, *Thompson*, Zool. Research., fasc. vii, t. 3, f. 4, 5; t. 4, f. 1, 1834.
BRANCHIPUS CHIROCEPHALUS, *Guerin*, Icon. Règ. An. Crust., t. 33, f. 3.
BRANCHIPUS DIAPHANUS, *M. Edwards*, Hist. Crust., iii, 368.
BRANCHIPUS PALUDOSUS, *Desmarest*, Consid. gén. Crust., 389, t. 56, f. 2.
— *Lamarck*, Hist. An. s. Vert., 2d. edit., v, 198.

Cancer stagnalis (*Linn.?*), *Shaw*, Linn. Trans., i, 103, t. 9, f. 4, 5.
Cancer paludosus (?), *Müller*, Zool. Dan., t. 48, f. 1-8.
— *Herbst*, Krabben, ii, 118, t. 35, f. 3-5.
Branchipus stagnalis, *M. Edwards*, Cuv. Règne Anim., édit. Crochart, Crust., t. 74, f. 2.
Ino piscina, *Schrank*, Faun. Boic., iii, 249, 1803.
Marteau d'eau douce, *Duchèsne*, Manuel du Naturaliste.
Remarkable aquatic insect, *King*, Phil. Trans., lvii, 72, t. 4, 1762.
Squilla lacustris minima, *Petiver*, Gazoph. Nat., i, t. 21, f. 7, 1709.

Description.—When full grown it is upwards of an inch in length, slender, of a cylindrical form, and nearly perfectly transparent. The male is more so than the female, but with a slight reddish tinge throughout. The tail is of a bright red; the large basal joint of the prehensile antennæ of a beautiful transparent bluish-green colour, tipped at the extremity, where the second joint arises with a fine red hue. The back of the female is of a blue colour, and the ovary, when full of ova, of a reddish-brown.

Hab.—Pools on Blackheath, W. B.; near Epping, E. Doubleday, Esq.; near Brighton, C. Ager; near Bristol and in Devonshire, Dr. Leach, Brit. Mus.; near Hammersmith, J. O. Westwood, Esq.

2—Artemia.

Cancer, *Linnæus*, *Rackett.*
Gammarus, *Fabricius*, *Pennant*, *Herbst.*
Artemia, *Leach*, *Desmarest*, *M. Edwards*, *Joly.*
Branchipus, *Latreille.*
Artemisus, *Lamarck.*
Artemis, *Thompson.*

Character.—Abdomen long, consisting of six divisions, shortly bilobed, and not divided into two caudal plates; cephalic horns of male flat, broad, and not furnished with any appendages.

Bibliographical History.—We are indebted to Dr. Schlosser for the first extended notice of this little animal, though he mentions it as having been indicated a short time previously in the 'Journal Britannique.' In October 1755, having visited the saltworks at Lymington, in Hampshire, he went to examine the salterns, or reservoirs where the brine is deposited previous to its being boiled. In this strong liquor he discovered a vast number of small insects, of a red colour, which tinged the whole cistern. These he examined with care, watched all their motions as they gambolled in their native element, and noticed the great difference which distinguishes the male from the female. Having made a tolerably accurate drawing, he wrote a description of them, and sent it in a letter to M. Gautier, in Paris, who had just at that time discovered a method of engraving in colours, and was engaged in publishing his work called 'Observations périodiques sur la Physique.' This letter appeared in the year following, 1756, with figures of the animal, male and female. Schlosser tells us that they were called by the workmen brine-worms, and are chiefly to be found when the liquor is very strong. Linnæus, in his tenth edition of the 'Systema Naturæ,' 1758, shortly describes it under the name of *Cancer salinus*, and Fabricius, in his 'Entomolog. Systemat.,' 1775, places it in the genus Gammarus, under the name of *G. salinus*. No particular description of the little creature, however, appears to be given by any personal observer after Schlosser's time, till the Rev. Mr. Rackett called the attention of the members of the Linnean Society to it, by reading a paper at their meeting, on the 16th of June, 1812, which was published in the eleventh volume of their 'Transactions,' in the year 1815. Mr. Rackett informs us, it is called the Lymington shrimp, or brine-worm, and that it occurs in greatest number in the salt-pits or reservoirs, where the liquor obtains the strength of a quarter of a pound of salt to the pint of water. When this liquor, he says, becomes much diluted with rain-water, a few only are visible in it.

Hitherto it had been described either as the *Cancer salinus* or the *Gammarus salinus*, according as authors chose to adopt the name given to it by Linnæus or Fabricius. Latreille, however, in the first edition of 'Cuv. Règne Anim.,' 1817, describes it as a species of Branchipus, referring it correctly to the Phyllopoda; and Leach, in the 'Dict. Sc. Nat.,' 1819, following up the arrangement, founded the genus Artemia to receive it, in which it has remained ever since.

More recently the *Artemia salina* has been studied with care by Mr. Thompson, who, in the fifth number of his 'Zoological Researches,' 1834, informs us he received some specimens of it from Lymington, and though the adults all died, he succeeded in hatching the ova contained in the brine, and bringing the young to maturity. He readily distinguished the male from the female, and has given a number of figures, illustrating the anatomy of the adult animal, and the various changes which the young undergo in their progress to maturity.

More lately still, M. Joly, of Montpellier, having found the species abundant in the salt-marshes in that neighbourhood, and more especially in the salt-pits or reservoirs, has devoted much attention to its study, and published a lengthened description of its anatomy and habits in the 'Ann. Sc. Nat.,' 1840. It seems curious, however, that he does not appear ever to have seen the males, and even asserts that Schlosser must have mistaken the young insect for the male, and that the horn-like antennæ, which he describes, must have been the provisional feet of the young before they had assumed the adult form. Apparently he had not seen the memoir of Thompson. In other respects his paper contains the fullest description, with the most copious and most accurate account of the manners and habits of this little creature, that has been published, and is concluded by a lengthened disquisition as to the cause of the red colour which frequently distinguishes them, and which tinges the whole water in which they occur with the same hue.

Anatomy and Physiology, &c.—The Artemia resembles the preceding genus so much in anatomical structure, that it is unnecessary to enter fully into details. The superior antennæ in both sexes, and the inferior in the female, are exactly similar to those of the Chirocephalus (t. II, f. 2 *b*). The prehensile antennæ of the male (t. II, f. 2 *a*) differ, however, in two or three respects. They are large, flat, and curved downwards towards the thorax, as in the Chirocephalus, and are also divided into two articulations. The first articulation is much more simple than that of the Chirocephalus, and has none of the complicated apparatus attached to it which is so remarkable in that genus ; while the conical, antenna-like appendage is firmly attached to its inner edge, and is not moveable. The second joint is flat, broad, bent nearly at a right angle about the middle of its length, and sharp-pointed.

The two lateral pedunculated eyes and the median sessile, black spot are precisely similar to those of the Chirocephalus, and the organs of the mouth do not differ in any circumstance but in the lip being rather more developed.

The divisions of the thorax are not quite so distinct as in the Chirocephalus, but they are of the same number, and as each division has attached to it a pair of branchial feet, these organs consist also of eleven pairs, notwithstanding that Latreille, followed by Desmarest, asserts they have only ten. In structure they resemble almost exactly those already described in the preceding genus (t. II, f. 2 *c*). They gradually increase in length from the first to the sixth, and decrease again from that to the eleventh.

According to Joly, the abdomen is only composed of six instead of nine articulations. The first has the external ovary attached to it in the female and the organs of generation in the male, while the last is by much the longest, and terminates in two short, conical prolongations, furnished at their extremities with a few short hairs. The external ovary is of a somewhat quadrilateral shape, opening at its lower extremity to allow the ova to escape. The digestive tube commences a little above the mandibles, and is preceded by a pharynx, consisting of two vesicles, which appear divided into cells, and present the appearance of convolutions similar to those of the brain of the superior animals.

The heart or dorsal vessel is exactly like what is seen in the Chirocephalus.

The Artemiæ are found exclusively in salt water, and though they do occur in salt marshes, still they are to be found in greatest abundance in water that is very highly charged with salt. "Myriads of these animalculi," says Mr. Rackett, "are to be found in the salterns at Lymington, in the open tanks or reservoirs where the brine is deposited previous to the boiling. It attains the desired strength by evaporation, from exposure to the sun and air, in about a fortnight. A pint contains about a quarter of a pound of salt, and this concentrated solution instantly destroys most other marine animals." In these reservoirs there is always a certain quantity of this strong brine allowed to remain, and there these little creatures are found in greatest abundance and in greatest enjoyment; whilst in what are called the sun-pans, where the brine is made by the admission of sea-water during the summer, and which are emptied every fortnight, they are never found at all. During the fine days in summer they may be observed in immense numbers near the surface of the water, and as they are frequently of a lively red colour, the water appears to be tinged with the same hue.* "There is nothing more elegant," says M. Joly, "than the form of this little Crustacean; nothing more graceful than its movements.

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* The fact that salt water, when highly concentrated, frequently assumes a red colour, has been often attributed to the presence of great numbers of the *Artemia salina*. Indeed the cause of this red colour, which was well known to take place in the salt marshes and reservoirs of salt water at Montpellier, was made, some years ago, the subject of very great discussion in France, before the Institute. M. Payen first maintained the cause to be the presence of Artemiæ; M. Duval, however, declared that it arose from microscopic vegetables, species of Hæmatococcus and Protococcus. After a keen

It swims almost always on its back, and by means of its fins and tail it runs in all directions through the element it inhabits. It may be seen to mount, descend, turn over, spring forward, curve its body into the form of an arch, and then rebound, and deliver itself up to a thousand bizarre and capricious gambols. Their feet are in constant motion, and their undulations have a softness difficult to describe." The tanks or reservoirs where I have already said they are chiefly found, are called clearers, as the liquor becomes clear while in them, and this effect is attributed by the workmen to this constant and rapid motion of their feet. "So strongly persuaded," says Mr. Rackett, "are the workmen of this fact, that they are accustomed to transport a few of the worms from another saltern if they do not appear at their own."

They are manifestly omnivorous, swallowing everything that comes in their way. Like the Chirocephalus, the undulatory motion of the branchial feet causes a current of water to flow in the kind of canal formed between them, which carries everything within reach to their mouth. In this way we see them devouring even their own young. "If we observe," says M. Joly, "in a small quantity of liquid, the mother at the time of parturition, we see the young group themselves round her body, and there is nothing more pretty, more agile, more graceful than this little troop. But soon the scene changes; one, two, or three young ones are involved in the current which the motion of its fins causes, they pass into the gutter situated between these organs, and from thence come to the mouth of the mother. She at first disperses them, as being inconvenient bodies—perhaps she may even wish to spare them; but soon afterwards they present themselves again,

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discussion between the two above-named *savans*, assisted by Messrs. Audouin and Turpin, M. Joly set himself to discover the real cause; and the result of his observations is, that the red colour depends upon the presence of myriads of a small monad, and that frequently the Artemiæ, from swallowing numbers of these, partake also of the same red hue. The little creature is called by M. Joly *Monas Durallii*, and a long account of the whole discussion may be seen at the conclusion of M. Joly's paper in the 'Ann. Sc. Nat.'

and pressed upon by the stiff hairs which form the branchiæ, then by the papillæ, lastly by the jaws, they arrive at the mandibles, reduced nearly to pulp, and they are swallowed as any other substance would be." Their enemies, in such a fluid as the Artemia inhabits, are not numerous; but their chief foe is a small beetle, allied to the Dytiscus, which M. Joly observed at Montpellier, and proposes to name *Hydroporus salinus*. When it meets an Artemia, it darts at it and bites it; it then retires for a short time, but returns to the attack again and again, till it succeeds, by numerous bites, in killing the poor creature, and devouring it with astonishing avidity.

The act of copulation does not appear to have been seen by any observer except Schlosser, who says the males seemed to be very eager to leap upon the backs of the females, and kept tight hold of them by their prehensile antennæ. "United thus, they remain some time together, and scarce are they separated when others take their place." The females appear to take the males even when they have already eggs in their external ovary, as Schlosser says he has observed the male embrace the female, in the part where the ovary is situate, so tight as to press out several ova; which causes him to remark: "Je n'ose décider si cette action est une véritable accouplement, et si mes insectes à bras sont les mâles ou les accoucheurs de femelles, n'ayant pas, par un très bon microscope, vu aucun autre chose que ce que je viens de vous dire." It appears, however, from M. Joly, who has isolated the females, that one fecundation must, as in most other Entomostraca, suffice for more than one generation.

The same author also asserts, that the Artemiæ are both oviparous and ovoviviparous, according to the season of the year. Before July and after September they only lay eggs; while during summer they generally bring forth young. In about twenty-four hours after the young are born or the eggs expelled, the mother changes her skin. To effect this she rubs herself either against the sides of the vessel or against any foreign bodies she may meet with in the water; and in spring and summer these moultings are of very frequent occurrence, succeeding each other at intervals of five or six days. About fifteen days, or at most three weeks, after the eggs are formed in the external ovary, they are expelled, and the mother lays three or four times, the number at each time varying from 160 in summer to 50 only in autumn. As is the case with the Chirocephalus, the young present, when first born, a very different appearance from what they assume when full grown (t. II, f. 4). They bear an exact similitude to the young of the Chirocephalus, and the various changes they undergo are precisely the same as those which they experience.

1. Artemia salina. Tab. II, figs. 2-4.

Artemia salina, *Leach,* Dict. Sc. Nat., xiv, 524.
— *Desmarest,* Cons. gén. Crust., 393.
— *Joly,* Ann. Sc. Nat., 2d series, xii, 225, t. 7, 8.
— *M. Edwards,* Hist. Nat. Crust., iii, 370.
— *Audouin et Payen,* Ann. Sc. Nat., 2d series, Zool. vi, 219, and x, 315.
— *Latreille,* Règne Anim., iv, 174.
Cancer salinus, *Linnæus,* Syst. Nat., 10th edit., i, 634; 12th edit., i, 1056.
— *Gmelin,* Syst. Nat., 13th edit., 2993.
— *Rackett,* Trans. Linn. Soc., xi, 205, t. 14, f. 8-10.
Gammarus salinus, *Fabricius,* Entomol. Syst., ii, 518.
— *Pennant,* Brit. Zool., iv, 22, No. 35.
— *Herbst,* Krabben und Krebse, i, 145.
Artemisus salinus, *Lamarck,* Hist. An. s. Vert., 2d edit., v, 199.
Artemis salinus, *Thompson,* Zool. Research., No. 5, 104, t. 1, f. 1-10, t. 2.
Branchipus salinus, *Latreille,* Règne An., iii, 68, 1817.
Brine-worm, *Schlosser,* Observ. périod. sur la Physique par Gautier, pp. 58-60, i, f. A, B, 1756.

Description.—Body linear; nearly half an inch in length. Cephalic horns in male large, flat, and two-jointed, the lower joint carrying a tooth on its inner edge, near the centre. Oviferous sac of nearly a quadrilateral form.

Abdomen bilobed at extremity, each lobe giving off several short setæ.

Hab.—Salt-pans at Lymington, Hants; Schlosser, Rackett, S. Stevens, Esq., 1848; British Museum.

Order II—CLADOCERA.*

Cladocera, *Latreille*, Cuv. Règne Anim., iv, 151.
— *Burmeister*, Beit. zur Naturg. der Rankenfuss.
Daphnides, *Straus*, Mém. Mus. d'Hist. Nat. v.
Daphnoides *ou* Cladocères, *M. Edwards*, Hist. Nat. Crust., iii, 372.
— — *Lucas*, Explor. Sc. de l'Algérie.

Character.—Body, except the head, which is distinct and projecting, entirely inclosed within a carapace formed of two valves, joined together on the back. Feet four to six pairs; articulations partly cylindrical, but chiefly foliaceous, branchiform, and not adapted for organs of motion. Eye single, and very large. Antennæ two pairs; inferior branched, large, and performing the functions of swimming organs. Mandibles without palpi.

Family I—DAPHNIADÆ.

Daphnia, *Müller*.
Daphnides, *Straus*, Mém. Mus. d'Hist. Nat., v.
Daphnidiens, *M. Edwards*, Hist. Nat. Crust., iii, 374 (exclus. Lynceus).

Character.—Superior antennæ generally very small; inferior, large, almost always two-branched. Five or six pairs of feet, all inclosed within the valves of the carapace. Eye single, large. Intestine straight.

Bibliographical History.—Swammerdam is the first author we know that has taken notice of any of the

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* Κλαδος, a branch; and κερας, a horn.

Daphniadæ, though he mentions that a species had been observed before his time by Goedart, and named by him "pou aquatique." * In his 'Historia Insectorum generalis,' published at Utrecht in 1669, he gives a pretty full description of a species of Daphnia, which is evidently the *Pulex*. He calls it *Pulex arboreus* or *arborescens*, the first part of which name has been retained, and applied to this species, by most authors who have written since his time. His description is not very correct in some points; for he says the beak is slender and pointed, and that it is by this sharp beak the animal draws up its food, as it were by suction, like other aquatic insects. He describes, however, its motions very well, and mentions the animal as occurring frequently of a red colour, or of the hue of blood. This memoir of Swammerdam is republished in his 'Biblia Naturæ,' where the same figures are also given.†

Merrett, in his 'Pinax rerum Britannicarum,' &c. London, 1677, mentions the Daphniæ, or at least is said to intend them, by the following short description: "Vermes minimi rubri, aquam stagnalem, colore sanguineo inficientes, unde vulgus dira portendit."

Francisco Redi, in his 'Osservazioni utorno agli animali viventi che si trovano negli animali viventi,' Firenzi, 1684, gives three figures of a species which Müller quotes as the *Pulex* (his *Pennata*), but which are so very bad, that it is difficult to make them out. He calls them by the name of "Animaletti aquatici." In his 'Opere,' published at Napoli, 1687, he gives the same figures as in the former work, and mentions them as "Tre animaletti aquatici, che vivorno nelli acqua stagnanti, e ne' pozzi, osservati col microscopia."

Bradley, in his 'Philosophical Account of the Works of Nature,' London, 1739, gives a long description of a

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* I have not seen any notice of this little creature in any work of Goedart that I have examined, and Straus remarks also that he had never been able to procure the work in which the notice of this insect occurs.

† Vide Leyden edition, 1737.

"wonderful insect which had but one eye," found in the river Thames, with a "head somewhat like that of a bird," and "legs like the claws of an eagle;" the large antennæ are described as "two branches, resembling the dugs of animals," and which, he says, "we might suppose were designed for suckling their young;" "for this insect," he adds, "is viviparous, which is contrary to other insects before mentioned; for we did not only observe the young ones alive in the belly of the mother, but likewise saw several of them excluded from her body." The figure which he gives is equally good as his description, both of them showing the force of imagination, for it is evident this "wonderful insect" is nothing more than the *Daphnia pulex.*

Trembley, in his 'Mémoires pour servir à l'histoire d'un genre de Polypes d'eau douce,' 1744, takes notice of, and figures, a species of Daphnia under the name of *Puceron branchu,* which seems to be the favorite food of the polypus, as they devour them in great numbers. It is the *Daphnia pulex,* and his observations on this subject, and figures also, are quoted and copied by Adams, in his 'Micrographia Illustrata,' published in London, 1746.

Linnæus, in his 'Systema Naturæ,' 4th edition, 1744, describes the same species shortly, under the name of *Monoculus pulex arborescens,* and in his 'Fauna Suecica,' 1st edit. 1746, and 'Entomologia Faunæ Suecicæ, 1789, he again describes it under the name of *Monoculus pulex.*

Baker, in his 'Employment for the Microscope,' 1st edit. 1753, describes and figures a species, which is evidently the *D. pulex.* He maintains that it has two eyes, and severely handles poor Bradley for saying it has only one, though that is about the most correct part of his description! He quotes Swammerdam's memoir, and retains his name for it, as expressive of its appearance and motion.

Joblot, in his 'Observations d'Histoire Naturelle, faites avec le Microscope,' 1754, describes a species of Daphnia under the name of *Pou aquatique,* which Müller quotes as his *D. sima*, but which Straus says is not so, but is his *D. macrocopus*. The figures which Joblot gives are very indifferent, and it is not easy to say what species they are meant to represent.

Schœffer, in his Memoir 'Die grünen Arm-Polypen die geschwanzten und ungeschwanzten zackiger Wasserflohe,' 1755, describes at great length two or three species, under the name of *Geschwanzten zackiger Wasserfloh*, and *Ungeschwanzten zackiger Wasserfloh*, or *water-flea with a tail*, and *water-flea without a tail;* and this memoir is the first in which an attempt is made to distinguish different species,—the various authors whom I have quoted above, having all, with perhaps the exception of Joblot, described only one and the same. He figures two species, the *D. pulex* and *sima*, and gives a sketch of the head only of a third, which, being provided with a tail, has been quoted by Müller and Straus as the *D. longispina*. This memoir contains a great deal of very interesting information with regard to these little creatures, and having been partly translated into French by Jurine, at the end of his work on the Monoculi, it has become more available to the naturalist. In his 'Icones Insectorum circa Ratisboniam indiginorum,' 1766, the same author figures the *D. pulex* under the name of "Branchipus conchiformis primus," and in his 'Elementa Entomologica,' published in the same year, I believe, he again figures it under the name of "Branchipus conchiformis."

Poda, in his 'Insecta Musæi Græcensis,' 1761, describes shortly the same species, under Linnæus's name, *Monoculus pulex*, and Ledermüller, in his 'Mikroskopischen Gemüths und Augen-ergotzung,' 1763, gives an indifferent figure of a species, which however is easily recognisable as the same.

Geoffroy, in his 'Hist. abrég. des Insectes,' 1764, gives a good many details of this genus generally, and describes a species under the name of "Perroquet d'eau," which Müller quotes as his *quadrangula*, but which Straus, I think more correctly, considers the *pulex*.

Goëze, in the 'Naturforscher,' 1775, describes the same species, under the name which Swammerdam had given to it, the *Pulex arborescens;* and Sulzer, in his 'Abjekürzte Geschichte der Insecten,' 1776, gives a very indifferent figure of what he calls *Monoculus pulex,* but which is evidently the *Daphnia vetula.*

Müller, in his paper on the Cypris, in the 'Philosophical Transactions' for 1771, has enumerated several species of Daphnia as occurring in Norway and Denmark, but under the general name of Monoculus. In 1776, however, he established the genus *Daphne,* in his 'Zoologiæ Danicæ prodromus,' and enumerated eight species, only three of which had ever been noticed before his time. In his 'Entomostraca,' 1785, he adds one other species, gives figures of all the nine, and a lengthened description of each. He changes the generic name from Daphne to Daphnia, which latter name has been adopted by succeeding authors, and alters the specific names of two species, though without good reasons for doing so.

De Geer, in vol. vii of his 'Mémoires pour servir à l'Histoire des Insectes,' 1778, gives a good many details concerning this family, pointing out two or three errors into which Swammerdam had fallen, and giving very accurate descriptions of some portions of their anatomy. He describes at length, and figures very nicely and with considerable faithfulness, four different species, two of which, previous to this, had only been noticed by Müller, in his 'Zoolog. Dan. prodrom.'

Blumenbach, in his 'Handbuch der Naturgeschichte,' 1779, mentions one species, the *pulex;* and Eichhorn, in his 'Beytrage zur Naturgeschichte der kleinsten Wasserthiere,' 1781, gives a tolerable figure of the same species.

Gmelin, in his edition of the 'Systema Naturæ,' 1788, gives all the nine species of Müller, and adds to them the *Monoculus pediculus,* which Müller had already formed into a genus by itself, the *Polyphemus.*

Manuel, in the 'Encyclopédie méthodique,' 1792, gives all Müller's species, merely quoting his descriptions and copying his figures.

Fabricius, in his 'Entomologia Systematica,' 1793, changes Müller's names in one or two instances, but does not extend the number of species; but Schrank, in the 'Naturforscher' for that year, describes a new one.

Donovan, in his 'Natural History of British Insects,' 1802, gives an indifferent figure of a species taken when in its young state, and which appears to be the *Daphnia vetula*. He calls it *Monoculus conchaceus*, and makes a few remarks upon its habits and manners, giving a frightful picture of its ferocity and cowardice! "By numerous filaments which it darts forth," he says, "it causes such a motion in the water as to attract unresistingly the insects floating into its mouth. Thus it exists," he concludes, "a life of rapine and destruction, enjoyed at the expense of the lives of thousands; and as the objects of its ravenous disposition are defenceless, so are they the sport of their conqueror; the few moments of intermission its craving appetite grants them, is occupied equally in the spoil, first pressing them to death, and then tossing them undevoured into the fluid. But should a more powerful insect oppose him, he immediately contracts his parts, and nothing more than the external covering is open to his antagonist's violence, and he will sooner die ignobly than offer the least opposition."

Latreille, in his 'Hist. Nat. gén. et part. des Crustacés et Insectes,' 1802, enumerates all Müller's species, retaining his names; and they are given in the same manner by Bosc, in his 'Hist. Nat. des Crust. édit. de Buffon, par Deterville,' 1802, both authors giving a number of general details with regard to the family.

Ramdohr, in 1805, published a detailed account of the anatomy of two species, the *sima* (*vetula*) and *longispina* of Müller, in his 'Beyt. zur Naturg. einig. deuts. Monoculus-arten.' Previous to his time, Schœffer, De Geer, and Müller, were the only authors who had attempted any particular anatomical details, and this memoir of Ramdohr added much to what they had done.

Lamarck, in his 'Hist. Nat. des Anim. sans Vertèb.' first edit. 1818, describes two of Müller's species, and Samouelle, in his 'History of British Insects,' 1819, gives one.

In Rees's 'Cyclopædia,' 1819, we have all Müller's species; while Leach, in his article "Crustaceology," in the 'Edinburgh Encyclopædia,' 1823, only mentions the *pulex*.

From the time when Müller's 'Entomostraca' appeared, up to this period, no additions to the species had been made; and, with the exception of Ramdohr's memoir already mentioned, no original matter had been published concerning the family, though, as I have already observed, this work of Ramdohr seems to have attracted no notice from any of the authors who succeeded him.

In 1820, Jurine's splendid work on the 'Monoc. qui se trouvent aux Envir. de Genève,' made its appearance, after the death of the talented and lamented author; it abounds in a variety of extremely interesting information, not only with regard to their anatomy, but to their habits and manners. About the same period, an elaborate and excellent paper on the family was read before the Academy in Paris, by M. Straus, and published in the 'Mémoires du Muséum, d'Hist. Nat.' 1821. To these two authors we owe the greater part of our knowledge of these curious animals; their labours and experiments having brought to light much information with regard to their economy, which had escaped all the previous writers. Jurine describes six species, which had not been observed by Müller, and Straus three, though some of them seem to be only varieties.

Desmarest, in his work 'Consid. gén. sur les Crust.,' 1825, enumerates fourteen species which had been described by the authors who had written before his time, and which had been found in France, but adds no new ones.

Gruithuisen has published a very interesting memoir upon the *Daphnia sima* of Müller, in vol. xiv of the 'Nova acta Physico-Medica Academiæ Cesariæ Naturæ Curiosorum,' part i, 1828, in which he describes at some length the circulation of the blood, as observed by him, in this insect. He describes two hearts, arterial and venous, and gives a figure, much magnified, of the blood in motion.* His figure of the creature itself, however, is not very correct, or it is a species different from that of Müller.

In M Edwards's work on the Crustacea, vol. iii, the reader will find a description of almost all the species known at the time of its publication, and to that we refer him, as containing the fullest list of described species belonging to this family.

Anatomy and Physiology, &c.—The body is composed of two parts, very distinct from each other: the one, much smaller and projecting, forms the head; the other, much larger, and consisting of a thorax and abdomen, is contained entirely within a very slender and delicate shell. The valves of this shell are, in most of the species, perfectly smooth round their circumference, but on the middle are marked, either with reticulations or deep crossed lines, in one or two species, forming a mesh-work, or, as Schœffer says, they are shagreened like the skin of a shark. They are open on the anterior margin, and united to each other along the posterior edge, as far as the extremity, but have no hinge, being as it were simply soldered together, to use the expression of Goëze, allowing the animal, however, to open and shut them to a certain degree at will. In some species these valves are prolonged posteriorly to a point, which, at some periods of their growth, and in some varieties, is very long, in others very short, and in some altogether wanting.

In the head, the covering of which is harder than the other portion of the shell, we distinguish the following parts: beak, antennæ, eye, brain, mouth, and masticatory organs, and part of the digestive canal.

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* L. c., t. xxiv, f. 6.

The thoracic and abdominal portions contain the remaining part of the alimentary canal, the heart, legs, and organs of generation.

The beak is merely a prolongation of the hard covering of the head; though it is asserted by Swammerdam to be the mouth of the animal, by means of which, being pointed, it sucks up its food. Both De Geer and Schœffer, however, pointed out the erroneous nature of this assertion; and later writers, such as Jurine and Straus, have still more clearly shown it to be wrong. At the extremity of this beak, and a little underneath it, we see two small projecting organs, which differ considerably in the two sexes; these are the superior antennæ (t. VIII, f. A, B, *b*; t. X, f. 1 *a*, 4 *a*). Schœffer, who is perhaps the first person who noticed these, considered them as palpi, by means of which the insect distinguished its food. Jurine calls them "barbillons" in the female; but Straus considers them correctly as the true antennæ of the animal, though he says they do not seem to possess any voluntary motion. In the female they are extremely small, and seem to have escaped Müller's notice altogether. In the male they are much larger, and were considered by the last-mentioned author as the organs of generation (t. VI, f. 1; t. XII, f. 1 *a*). Jurine describes them very particularly in the *pulex*, calls them "harpons," and says, they occupy the place of the "barbillons" of the female. They vary in the different species, and are each composed of several articulations. They seem to assist the first pair of feet in retaining hold of the female during the act of copulation. On each side, upon the base of the head, are inserted the large antennæ. They consist each of a single joint at the base (t. VIII, f. A, *a*), dividing into two branches. This basal joint is slightly conical, generally of about the length of the head, and very flexible at its root, having a joint there, which unites it to the body, and facilitates its motions in every direction.

The posterior of the two branches is divided, in most of the species, into four articulations, and the anterior into three. Both branches are furnished with several long filaments or setæ, which, in some of the species, as the *pulex*, are beautifully feathered, or plumose, and consist each of two moveable joints, which augment their flexibility. Swammerdam calls these organs the arms, and describes their motion very particularly, which, he says, is threefold; *rectilinear*, up and down, and to each side; *unequal*, keeping the animal now at the bottom, and then at the top of the water, which sort of motion he compares to the flight of a sparrow; and *gyratory*, by which the animal moves itself in a circular manner. De Geer also calls them arms; but Müller, and most other naturalists after him, call them antennæ. Jurine, however, calls them "bras ramifiés," and Straus, considering them as the chief or almost only organs of locomotion, and acting as it were as fins, calls them rami or "rames branchues;" they are, in fact, he says, a first pair of feet, and act as such, as it is by means of these organs alone that the animal moves, the other feet not serving at all for that purpose.

The eye (t. VIII, f. A, B, *c*) is a spherical body, furnished with powerful muscles, so arranged as to allow it to possess a semi-rotatory motion upon its centre, and is composed of about twenty crystalline lenses, which are limpid, and when isolated are each pear-shaped. Swammerdam asserted that there were two eyes, which seemed to be joined together, and several authors have adopted the same opinion. Schœffer, however, says there is only one, and Müller and De Geer repeat this,—an opinion which has also been adopted, and proved correct by Straus and Jurine. Eichhorn, as quoted by Straus, mistook the eye for the stomach!

The brain, or first ganglion of the nervous system, is situate near the eye, and is composed of two lobes, from the superior anterior commissure of which we see, going off to the eye, the optic nerve. The mouth (t. VIII, f. B) is rather of a complicated structure, is situate near the junction of the head and body, near the base of the beak, and consists, according to Straus, who has given the most correct account of this organ, of a labrum or lip, two mandibles, and one pair of jaws. The labrum or lip (f. B, *g*, and f. C) consists of a flattish body, compressed at the sides, and has at its extremity a large lobule, furnished with several setæ. It is fixed to the posterior part of the base of the beak, is very moveable upon its antero-superior angle, and by means of powerful muscles (f. C, *a*, *b*, *c*) admits of a considerable separation.

The mandibles (f. D) are very strong, and consist each of a stout fleshy-looking body, which, at its superior extremity, is in form of a narrow point, and articulates there by means of several muscles with the body (f. A, *f*). It descends from thence vertically to the mouth, its inferior extremity being curved sharply inwards, so as to penetrate into the mouth between the lip and corresponding jaw, and terminates in a free unattached edge, which has apparently neither teeth nor triturating surface, but which when pressed closely between two pieces of glass, may be observed to be provided with a series of about eight small teeth, slightly curved. These mandibles are not provided with either palpi or branchiæ, but are quite naked, and are moved by two muscles; an abductor, which moves them upon themselves from within outwards, and an adductor, which brings them back to their first position, at the same time bringing them nearer, each to the other. The motion of these organs, when the animal is feeding, is semi-rotatory.

The jaws (f. A, B, *p*, and f. F) consist each of a strong body, somewhat rounded on the anterior surface, and terminated by four strong horny spines, three of which are prolonged into hooks, strongly curved forwards and inwards. The fourth being small and straight. These parts seem to be constantly in motion, as if the animal were perpetually employed in eating. The mouth, as I have already stated, was placed by Swammerdam at the extremity of the beak,—an opinion adopted also by Ledermüller. Schœffer was the first who showed its true situation, and De Geer confirmed his observations. Schœffer describes also the two mandibles, and fancied he likewise saw the lips, but could not make them out distinctly, from the smallness of the animal.

The digestive canal (t. VIII, f. B) commences immediately behind the mouth, in the form of an œsophagus, which is short, narrow, slightly curved, and stretches obliquely forwards and upwards, terminating immediately behind the brain, in the stomach.

The stomach (f. B, *e*) is in form of a large vessel, curved at its upper part into a complete arch, nearly straight in its course downwards through the body, and suddenly bending up again in the abdomen. It runs almost all the length of the animal, opening by the anus between the first two dentated arches of the posterior part of the last segment of the body. Immediately behind the eye, near the cardiac extremity of the stomach, we see two vessels (f. B, *d*), curved upwards, in the form of a letter S reversed, the arch turned towards the eye; these are described by Schœffer, who considers them as organs for furnishing the necessary juices for the nourishment of the body. De Geer says they resemble cæca. Jurine supposes them to be organs proper for furnishing a juice destined to perfect digestion. Straus at first considered them as such also; but, upon more mature examination, at length concluded them to be really cæca.

The body of the animal is quite free, and unattached within the valves of the shell. It is slender and long, and is divided, according to Straus, into eight segments; the first of which is the largest, and is the only one which is attached to the valves. At the second segment the body suddenly diminishes in vertical diameter, sinking down, and leaving above a strong projection, formed by the first segment. From this projection, throughout the rest of its extent, the body is unattached to the shell, and leaves a vacant space between it and the edge of the valves, into which the animal deposits the eggs after laying them, and where they remain till hatched, and ready to be launched into the world. The seventh segment is provided with two filaments, which have an articulation about the middle of their length, like those of the rami. In the last segment we perceive two dentated arches, between which is situate the anus. Beyond this it contracts in size, and terminates in two horny hooks, the last of which is the longest. The whole of the body, except the first segment, as I have already said, is free and unattached, and the insect can extend it beyond the valves at pleasure, the two hooks at its extremity serving well for enabling it to clear the interior of the valves. It seems also to clear the feet from any particles of mud or dust adhering to them; and Schœffer thinks it may also assist in bringing before the mouth objects of food. He says also, that perhaps the motions of the insect are partly regulated by the strokes of this body, or tail, as he calls it, and certainly it is in almost constant motion when the animal swims. On the back, in the first segment of the body, we see an ovoid-shaped vesicle (t. VIII, f. B, *i*), possessed of very rapid contractions; this is the heart. According to Jurine, there springs from its anterior extremity an arterial vessel, which contracts in an opposite manner to the heart itself, curves immediately from its origin, and goes backwards, following the direction of the intestinal canal. Gruithuisen describes the heart and circulation at greater length. He says, there are two hearts, one venous, the other arterial: the venous supplies the intestines and other parts of the body with blood; the arterial supplies the head and parts connected with it, its branches making the circuit of the shell on the anterior edge, and collecting near the posterior inferior part into one large trunk, which runs along the back of the shell, and returns to the arterial heart again.

The legs are five pairs, all differing in many respects from each other, and serving a different purpose than as organs of locomotion. The first pair (t. VIII, f. E) is smaller than the three succeeding pairs, and is the most simple of construction. It is situated immediately behind the mouth, being inserted into the body of the animal by the basal joint, which is broad and somewhat fleshy. Attached to it is another joint of a triangular shape, and having on its outer edge three small projections, each furnished with four or five long and strong setæ (analogous to the branchial plate of the succeeding pairs). At the extremity of this joint is another very small one, which is also furnished with one or two long setæ. All these setæ are jointed at about the middle of their length, and are not plumose.

The second pair (t. VIII, f. F) is larger than the first, and is inserted into the body a little behind it. It consists of four articulations; the basal broad, the second somewhat quadrilateral and flatter, with three projections at one extremity, the two internal sending off each one long plumose seta, and the external sending off three, equally plumose. On each side of this second joint there is situate another, one slightly quadrilateral, and sending off from its external edge fifteen long setæ, all jointed, the external being much the longest and finely plumose; the other narrower and oblong, and furnished at its extremity with two plumose setæ. The larger of these two may be considered as a branchial plate. In the third pair (t. VIII, f. G), the second joint is longer than that of the preceding pair, and sends off from its inferior extremity two short simple setæ. The branchial plate is attached to its external face, is larger and longer than in the preceding pair, and has numerous filaments on its free edge (Straus reckons seventy-six). The fourth articulation is larger than that of the preceding pair, is broad and nearly quadrilateral, and sends off six long plumose setæ, four from the inferior edge, and two from its internal side. The fourth pair (t. VIII, f. H) is similar to the third. The branchial plate has fewer filaments (Straus reckoning only sixty-five), and the fourth articulation is more oblong, and larger. The fifth pair (t. VIII, f. I) differs in many respects from the four preceding. It is more rudimentary in form, and can apparently be less readily divided into articulations. The part corresponding with the branchial plate is rounded, and has no filaments springing from its edge. Immediately above it there arises a strong-jointed, plumose spine, which is curved backwards upon this plate, while the third and fourth articulations are represented by finger-like processes springing from the inferior extremity of the foot, and sending off two or three plumose setæ.

Jurine says this last pair of feet are not inserted into the body of the animal, but the one is confounded with the other on the opposite side, the junction of the two forming the commencement of a gutter or canal, which extends along the immediate attachment of the feet to the mouth, where it terminates. These five pairs of feet are in almost constant motion, even when the animal is still and at rest, and their use at such times is to communicate an undulatory motion to the water, from one pair to another; thus establishing a current which enters the shell by the anterior part, carrying the molecules, &c. in the water to the posterior part where the gutter commences, and there being driven by the vermicular motion back again to the anterior extremity of the canal or mouth. None of these feet are used for locomotion. The first and second pairs, according to Straus, are used as organs of prehension. According to Jurine, the chief action of the first pair is to direct the alimentary particles brought up by the current of water, along the canal above described, into the mouth. When the mouth is opened, says the same author, to receive the food, the motion of all the feet, except this first pair, ceases, but in them, on the contrary, it is then accelerated. The grand use of the third and fourth pairs is respiration, being adapted for that function by their branchial plates, which, as De Geer had already observed. serve the same purpose to these insects as the gills of crabs, certain aquatic insects, larvæ, and fishes. The basal joints of these feet were considered by Schœffer as pockets filled with a liquid destined for the reproduction of the shell at each moulting. This opinion, however, has never been verified by any succeeding observer.

Till Jurine and Straus described these insects, the number even of the pairs of feet seemed undetermined. Joblot *believes* there are *three* pairs. Schœffer says there are *one* or *two* pairs more. Müller describes *five* pairs in *D. pennata* (*pulex*), but *four* only in his *longispina*. All the species of true Daphnia, however, have five pairs.

In the male, the first pair of feet (t. XII, f. 1 *b*) differs considerably from the corresponding pair in the female. It is more slender in form, and has a strong claw or hook attached to the extremity of the second joint, while the seta which springs from the third joint is very long, nearly the length of the body, and floats outside the shell. Jurine describes this pair of feet very particularly, and shows the use of them to be the same as the hinge-joint antennæ in the male Cyclops, viz., for seizing and retaining hold of the female during the act of copulation, the male introducing them along with the superior antennæ, into the interior of the shell of the female, and grasping her feet.

The male organs of generation have never been observed, Müller having mistaken the superior antennæ for them; neither have the female organs been seen, with the exception of the ovaries. That they reside in the lower portion of the body appears most probable, from the description to be afterwards given of the method of copulation, as observed by Jurine.

Straus thinks they have no external organs at all, but that the male simply injects the semen under the valves of the female, from which it introduces itself into the ovaries.

The ovaries are placed along the sides of the abdomen, as in Cyclops, and show their situation by the matter of the eggs, in the shape of small, round, pellucid globules. These make their appearance in the young insect after the third moulting; and gradually after that increase in size, lose their transparency, become continuous, and form a dark mass on the outer edge of the intestine, partly globular and partly elongated. At the sixth segment of the body, the ovary communicates with the open space on the back of the animal already described, and immediately after the fourth moulting, we see the eggs already laid and deposited in this space, where they remain till fully hatched.

The animals belonging to this family are only to be found in fresh water, generally in ponds and ditches; some preferring those in which there is much of the lemna, or duckweed, floating on the surface, others delighting in horseponds where cattle come to drink. In such places they are often to be found in myriads, and almost the whole year round; and as they sometimes in some species assume a red colour, they have been said to have tinged the water with the hue of blood. Swammerdam was the first who observed this; he says he has seen them in such numbers at Vincennes, as actually to give the water of a horsepond the colour of blood; and he quotes a friend of his in Holland, a Dr. Schluyl, who had noticed the same in one of the canals near his house. This statement has been repeated by Derham,* and by many others, upon Swammerdam's authority, but not, as far as I know, from personal observation.† I have, however, frequently seen large patches of water in different ponds assume a ruddy hue, like the red rust of iron, or as if blood had been mixed with it, and ascertained the cause to be an immense number of the *D. pulex.* The myriads necessary to produce this effect is really astonishing, and it is extremely interesting to watch their motions. On a sunshiny day, in a large pond, a streak of red, a foot broad, and ten or twelve yards in length, will suddenly appear in a particular spot, and this belt may be seen rapidly changing its position, and in a very short time wheel completely round the pond. Should the mass come near enough the edge to allow the shadow of the observer to fall upon them, or should a dark cloud suddenly obscure the sun, the whole body immediately disappear, rising to the surface again when they have reached beyond the shadow, or as soon as the cloud has passed over. They are very prolific, giving birth to their young a great many times during their lives, and some of the larger species having as many as forty or fifty eggs and upwards in their matrix at once. According to Jurine, in June the young ones begin to have eggs, about ten days after their birth, and it is probable they continue to produce all the summer through at frequent intervals. The males are very few in number, compared with the females, and are only to be met with at certain seasons, generally, as far as my observation goes, in autumn. From this circumstance, Schœffer and others have considered them as hermaphrodites; and Sulzer (as quoted by Straus), though he oppugns this opinion, gives a more singular one still, believing that a copulation might take place with the young before they see the light of day! These authors had never seen the males, nor ever witnessed the act of copulation. Müller and others, however, detected the male, and witnessed the act; and it is now clearly ascertained that one single copulation is sufficient not only to fecundate the mother for her life, but all her female descendants for several successive generations. This was observed by Schœffer, who followed them up to the fourth, by Straus to the fifth, and by Jurine to the sixth; the latter observing that he thinks it probable it might extend in some species to the fifteenth generation. Extraordinary as this may appear, I have further found that the young produced from the ephippial eggs are also fecundated by this one copulation, and have progeny; and that their young again also produce eggs without the intervention of the male. I have followed up the successive generations, as far as the fourth, in the Daphniæ born in the usual manner, and as far as the third, in those born from ephippial eggs; and have found, from repeated experiments, that those Daphniæ which had ephippia became loaded with eggs soon after they had thrown off these organs, and had progeny again, without the intervention of males; and that the young so born from these Daphniæ, which had thrown off their ephippia and become pregnant, were also independent of the access of the male, and became mothers in the same manner as the young of other Daphniæ.

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* Physico-Theology, p. 364, note a; Glasgow, edit. 1745.

† Merrett perhaps is an exception to this remark. See above, p. 63.

November 29th, I isolated a *D. pulex* with an ephippium; 30th, ephippium is thrown off; December 4th, Daphnia has eggs; 8th, young ones are born; 9th, the mother, having been removed from the young immediately after their birth, was found to have eggs again; 16th, young ones born; 20th, has eggs again; 24th, young ones born; 25th, has eggs again; Jaunary 6th, young born—mother has eggs in ovary again; 14th, young born —mother again has eggs; 22d, young born; February 1st, has eggs again; 8th, young born.

On the 8th December isolated one of the young born from the subject of last series of observations on the 30th November. On the 21st December she was found to have eggs; 28th, young born; 29th, has again eggs; January 9th, young born—mother has eggs again; 24th, young born; 25th, has eggs again; February 1st, young born—mother has eggs again; 9th, young born; 27th, has eggs again; March 8th, young born.

In both of these experiments the young were always removed from the vessel in which the mother was kept as soon as born.

On the 2d November I placed several ephippia in a glass of clear water. On the 10th two young Daphniæ were born—isolated one of them; December 12th, this Daphnia has given birth to several young, and has eggs again; 18th, has again given birth to several young; 19th, has eggs again; 24th, young born; 25th, has again eggs; January 6th, young born; 25th, after two several moultings without producing eggs, has again become pregnant; February 1st, young born.

On the 5th December isolated a young Daphnia born from an ephippium; January 18th, it has given birth to young; 19th, isolated two of these, both females; February 8th, both of these have given birth to young; isolated two of them.

I was at this period obliged, from circumstances, to suspend my observations; but the above experiment is sufficient to prove the fact, that the young born from an ephippial egg produce young, which in their turn become mothers without the intervention of the male. According to Jurine, who has watched the act with great care, the following is the manner in which copulation is effected. When the male attacks the female for this purpose, he springs upon her back, and gradually descends, till he reaches the inferior edge of her shell, and finds himself in a position where the open edges of the shell are opposed to each other. He then introduces the antennæ and first pair of feet into the interior of her shell, and with them embraces her feet. Thus fixed, he curves up his tail so as to touch the female, who at first is much agitated, but after a little time pushes out her tail also. They touch each other, and then they separate, the male at the time of touching having been agitated with convulsive motions. The eggs are first to be seen in the shape of small, round, pellucid globules, which mark the situation of the ovaries placed along the sides of the intestine. These soon lose their transparency, become enlarged and continuous, and form a dark mass on the outer edge of the intestine, partly globular and partly elongated. The creature now changes its covering, and shortly afterwards the eggs quit the ovary, and take their place in a spherical form in the open space on the back of the animal, where they remain till the time of expulsion, quite free and unattached. At first they are quite round, and appear to consist internally of little globules, like air-globules. The shape then alters a little, becoming oval, and the globules augment in number, but as yet no trace of any part of the body is recognisable. A little afterwards we see a black spot in the centre, which is the eye, and is the first organ visible. The other organs then begin to show themselves, but it is not till near the end of the fourth day, or ninety hours after laying, that motion is perceptible. At the end of the fifth day the young are launched into open day. They are from the first exactly like the parent, undergoing no metamorphosis, but merely differing in the less complete development of parts. In the case of the *D. pulex*, the young are born with the prolonged spine at the extremity of the valves curled up within the shell; and very shortly after birth, a few seconds after they have begun to move about in the water, this tail may be seen to spring forth with a sudden jerk, and assume its natural position. The setæ of the large antennæ or rami may also be seen to spring out in the same sudden manner, having been apparently folded up along the stem. During the time this process is going on, the little creature may be seen frequently stopping in its career through the water, bending up its body within the shell, and pushing it quickly out again beyond its edges, while the large antennæ are bent downwards, so as to enter the interior of the shell, where they are embraced by the feet, and quickly drawn through them, so as to catch the ends of the setæ, and raise them up. At this time the motions of the animal are exactly like those of the common house-fly, when it stops to clean its wings and feet. This sudden evolution of these parts is attempted to be accounted for by Straus, from the instantaneous flow of blood into these organs. In a very short time after birth the young animal is exactly like the parent, and gradually increases in size, till the shell becomes too small to hold it, when it throws it off, and comes forth with a new and a larger one.

This process of moulting is very curious, and all-important for the life of the animal. The intervals between them vary according to the season of the year, being shorter in summer than in cold weather. Schœffer says it takes place in the young every two days, which agrees very nearly with Jurine's experiments, performed in the month of June. In winter the intervals are somewhat greater. In the month of December I found, when kept in a vessel in my room, the intervals thus: December 8th, young one born; 12th, moulted for the first time; 14th, moulted a second time; 17th, moulted a third time; 21st, moulted a fourth time, and has eggs; 29th, moulted a fifth time; January 9th, moulted a sixth time; 19th, moulted for the seventh time. In a young *D. pulex*, born from an ephippial egg, the intervals were as follow: December 5th, young one born; 13th, moulted for the first time; 17th, moulted a second time; 24th, moulted a third time; January 3d, moulted a fourth time, and has eggs; 11th, moulted a fifth time; 18th, moulted a sixth time.

Each time it moults it increases in size, the moulting being evidently necessary for the gradual growth of the animal. The process does not seem to stop, however, when it has acquired its full growth, but, as far as I am able to judge, continues during its whole life, even long after it has gained its full size. The shell of the adult Daphniæ, when in very stagnant waters, soon becomes overgrown with moss or parasitic infusoria, and thus the animal's motions become much impeded, and at last entirely destroyed; the moulting, therefore, seems to be necessary in the full-grown animal for the preservation of its life, for weak or sickly individuals may be seen frequently so overgrown with Confervæ, &c., that motion and life are both soon arrested, the little creature apparently not having strength enough to throw off its exuviæ. At the fourth moulting* the young insect has eggs, which are deposited in the open space on the back, almost immediately after the old shell has been cast off. The time that the eggs remain there varies according to the season of the year. In summer, according to Jurine, three days;

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* Straus says after the third; Jurine, generally between the third and fourth. I have invariably found it to be immediately after the fourth.

according to Straus, from four to six. In winter I have found the interval between the eggs being deposited in the open space and the young being born to be eight days, as may be seen in the experiment detailed above. Moulting takes place every time after the young are born; and generally within a very short period after the change has taken place, eggs are again deposited. Occasionally, however, this does not take place, and then the animal remains without eggs for a space of time equal to that of carrying the eggs, when she moults again, and then has eggs. Straus says, that the young of the same laying are, generally speaking, all of one sex, the two sexes being seldom found together in the same birth. He also says that the Daphniæ cease to produce at the approach of winter, and to change their skin, and that they die before the commencement of frost. This does not accord with my experience, having found them in considerable numbers, producing young and moulting as late as the month of December, after both frost and snow had taken place. Indeed, I have found them as late in the season as February, though not in great numbers; but about that time they seem to disappear, and perhaps in a severe winter they perish earlier, as young individuals only are generally to be met with in the spring.*

At particular seasons the Daphniæ may be found with a dark opaque substance on the back of the shell. This is what I have so frequently mentioned above as the ephippium, so called by Müller, from the resemblance it bears to a saddle. This author was the first who took notice of this curious appearance; but though he describes it well, and has given an accurate representation of it, he does not give any opinion upon the cause or use of the formation. Jurine next noticed it; he describes it carefully, traces its gradual formation from matter contained in the ovary, and states it as his opinion, that it is a disease these little creatures are subject to, the effect of which is to arrest their future fecundity. Straus, however, has been more fortunate in his observations upon this anomalous production, and has proved it to be a substance containing two eggs, destined, he says, for the future generations of the species in the spring, these eggs resisting the cold of the winter, which proves fatal to the perfect animal. He says they are generally to be met with in the months of July and August. Jurine mentions them as occurring as early as May, and I have found them in abundance upon the animals as late as the month of November. The description of its formation, given by Jurine, is very accurate, though he is wrong as to its physiology.

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* In a mild season they may be found all the winter through; and even in the beginning of March I have found the *D. pulex* in great abundance and of large size, many also with ephippia.

After the third moulting has taken place, we may see a green matter in the ovaries, which differs both in colour and appearance from that of the eggs. After the fourth moulting this green matter passes from the ovaries into the matrix or open space on the back, and there spreading, forms the ephippium. At first it is of a grayish colour, and some hours after becomes of a black hue. When examined by the microscope, it appears of a dense texture, composed of a sort of network of hexagonal cells. In the centre of this opaque mass we see one or two round or rather oval bodies, called ampullæ by Straus, who says they are capsules, opening like a bivalve shell. In each of these bodies is contained an ovum, covered with a horny shell, by which means they are protected from the severity of winter, and enabled to resist an intensity of cold which kills the parent.

At the fifth moulting the animal abandons the ephippium, which floats on the surface of the water, and remains, with the two eggs inclosed, till next spring, when the young are hatched by the returning warmth of the season. "These two kinds of eggs," says Straus, "produced by the same animal, offer a very singular example in the history of animals, and show with what wisdom nature provides for the preservation of her smallest creatures." Straus says he has frequently hatched the young from these ova by suddenly bringing them into a warm temperature. I have, by repeated experiments, ascertained the truth of Straus's statement, and frequently witnessed the young hatched from these ephippial eggs, by keeping them in my room in a genial temperature.

On the 2d of November I took several ephippia, which I found floating on the surface of a saucer full of water, containing numbers of *D. pulex,* many of which had ephippia attached to them, and placed them by themselves in a glass of clear water. On the 10th, two young ones were born; 16th, one more born; 29th, two more born; 21st, one more; and 23d, two more born.

November 29th, I took several ephippia from the same saucer as the last, and isolated them in the same manner. December 5th, three young ones are born; 6th, two more; 8th, two more; 10th, two more; and on the 16th, one more, were born.

On the 19th of November I isolated a Daphnia, with the ephippium attached; 21st, it has thrown off the ephippium; December 5th, one young one is born from the ephippial eggs. I have repeatedly performed the same experiment, and have always found similar results. The young from these ephippial eggs do not differ from those born naturally, unless that they are perhaps a little longer in coming to maturity.

In a young *D. pulex,* born naturally on the 8th of December, it moulted the first time on the 12th, or four days after birth; on the 21st, or thirteen days after birth, it moulted for the fourth time, and had eggs; whilst in a young one of the same species, born from an ephippial egg on the 5th December, the first moulting took place on the 13th, or not till eight days after birth; and the fourth, when she had eggs, not till the 3d January, or twenty-nine days after birth. The periods between each moulting are also longer than in the others.

It has been asserted, as I have mentioned above, by Jurine, that these ephippia are the consequences of a disease these animals are subject to, and that they have the effect of arresting their future fecundity. From the experiments I have detailed above, and from similar ones made previously by Straus, it is evident that they are not a disease, and that instead of being so, they contain ova of a particular nature, destined to outlive the severity of the winter, and to perpetuate the species, which would otherwise perish altogether. From some experiments which I instituted upon this subject, I also found that Jurine is wrong in asserting that they arrest the future fecundity of these little creatures.

On the 29th December I isolated two specimens of *D. pulex*, with their ephippia attached. On the 30th both had thrown off their ephippia, and both had moulted. Upon close examination, I found that on the shell where the ephippia were situated, there was left a mark corresponding to its figure, and a scar or deeper mark was visible where the ampulla containing the ova had been. In the ovaries were to be seen the transparent globules or first appearance of the ova. On the 4th December both had eggs lodged in the matrix, and on the 8th the first family were born.

I watched the further progress of one of these Daphniæ. On the 16th December she had given birth to a second family, but did not moult till the 20th, when she again had eggs in her matrix; and on the 24th she gave birth to a third family. On the 6th of January she had given birth to a fourth family; January 14th she has given birth to a fifth progeny; January 22d she has had a sixth family. One or two other experiments, with similar results, prove satisfactorily that the assertion of Jurine is incorrect.

The motion of most of the species belonging to this family is chiefly by short bounds through the water, the most important organ producing the motion being the large antennæ. Such, in particular, is the manner of swimming of the *D. pulex* and *rotunda*, &c.

Many of the Entomostraca have the faculty of returning to life after having been completely dried. Schœffer instituted a series of experiments upon this subject, with regard to the Daphniæ, and his results are, that after having exposed the insect with eggs in the matrix for a considerable time to a dry atmosphere, and then replacing it in water, the eggs did not lose their vitality, but were after a time hatched as usual. Sulzer, as quoted by Straus, says the parents return to life also; but in the experiments reported by Straus, he never found either the mother or the eggs recover their vitality. The food of these animals, according to Straus, consists of vegetable matter, and not animal; but I have no doubt that they are carnivorous, as I have invariably found, that of two groups placed in separate vessels of clear water, the one having only particles of vegetable matter placed beside them, while with the other there were also introduced infusorial animalcules, the latter were much stronger and more active, and throve better than the former. (Vide supra, p. 6.)

I have divided the animals belonging to the family Daphniadæ into two sub-families, according to the number of their feet and the construction of their large antennæ or rami.

DAPHNINA.

Five pairs of feet. Inferior antennæ, two-branched; one branch divided into four, the other into three articulations.

1. Daphnia.—Head produced downwards into a more or less prominent beak. Superior antennæ exceedingly small, one-jointed, and situated under the beak.

2. Moina.—Head rounded and obtuse. Superior antennæ of considerable length, one-jointed, arising from the front of the head, near the centre.

3. Macrothrix.—Head terminating anteriorly in a sharp beak, directed straight forwards. Superior antennæ of considerable size, one-jointed, and hanging pendulous from the beak.

4. Bosmina.—Head terminating anteriorly in a sharp beak, directed straight forwards. Superior antennæ long, many-jointed, and projecting from the extremity of the beak.

SIDINA.

Six pairs of feet. Inferior antennæ two-branched; a row of spinous filaments springing from the edge of larger branch. Superior antennæ of moderate size.

1. Sida.—One branch of inferior antennæ with three, the other with two articulations.

2. Daphnella.—Both branches of inferior antennæ, consisting each of only two joints.

DAPHNINA.

Genus 1—Daphnia.

Daphne, *Müller*, Zool. Dan. Prodrom.
Daphnia, *Müller*, Entomostraca.
— *Straus, Desmarest, Latreille, Lamarck, Bosc, Leach, M. Edwards*, &c.
Monoculus, *Linnæus, Poda, Blumenbach, De Geer, Jurine, Manuel*, &c. &c.

Character.—Head produced downwards into a more or less prominent beak. Superior antennæ exceedingly small, one-jointed, and situated under the beak; inferior antennæ large and powerful.

1. Daphnia pulex. Tab. VI, figs. 1-3, male and female; Tab. IX, fig. 5, jun.; Tab. VII, figs. 3, 4, Var. *longispina*; Tab. XI, figs. 3, 4, 5. Var. *magna*.

Monoculus pulex, *Linnæus*, Syst. Nat., 10th edit., i, 635, No. 4, 1758; 12th edit., i, 1058, No. 4.
— *Gmelin*, Syst. Nat., 13th edit., i, 2999, No. 4.
— *Poda*, Ins. Mus. Græcens., 124.
— *Müller*, Faun. Insect. Friedrichsdalens. 95.
— *Blumenbach*, Handbuch der Naturg., 399.
— *Manuel*, Enc. méth., vii, 722, No. 15, t. 265, f. 1-4.
— *Fabricius*, Entomol. Syst., ii, 491.

Monoculus pulex, *Leach*, Encyc. Brit., art. Entomol.
— *Jurine*, Hist. des Monoc., 85, t. 8, f. 1-2, t. 11, f. 1, 3, 5.
— *Cuvier*, Tab. Elément., 455.
Daphne pulex, *Müller*, Zool. Dan. Prod., 199, No. 2400, 1776.
Daphnia pulex, *Latreille*, Gen. Crust. et Ins., i, 17; Hist. Nat. gén. et part. des Crust., iv, 223; Règne Anim. Cuv., édit. 2d, iv, 171.
— *Lamarck*, Hist. Nat. des Au. s. Vert., édit. 2d, v. 181, No. 1.
— *Samouelle*, British Insects, 80.
— *Straus*, Mém. du Mus. d'Hist. Nat., v, t. 29, f. 1-20.
— *Desmarest*, Consid. gén. sur les Crust., 372, t. 54, f. 3, 4.
— *Baird*, Ann. Nat. Hist., i, 254, t. 9, f. 1-12 (for details).
— *M. Edwards*, Hist. Nat. des Crust., iii, 379.
— *Guerin*, Iconograph. Crust., t. 33, f. 1.
— *O. Fabricius*, Faun. Grœnland., 263.
— *Leach*, Edin. Encyc., vii, art. Crustaceol.
Daphnia pennata, *Müller*, Entomost., t. 12, f. 4-7.
— *Bosc*, Man. d'Hist. Nat. des Crust., ii, 280.
— *Schrank*, Faun. Boic., iii, 264.
Monoculus pulex arborescens, *Linnæus*, Syst. Nat., 4th edit., 96; Faun. Suec., 344.
Pulex arborescens, *Swammerdam*, Hist. Ins. Gen., 76, t. 1, f. *a, b, c*; Biblia Naturæ, 86, t. 31, f. 1-3.
— *Goëze*, Naturforscher, pt. 7.
Monoculus pulex ramosus, *De Geer*, Mém. pour servir à l'Hist. Ins., vii, 442, t. 27, f. 1-4.
Daphnia ramosa, *Koch*, Deutsch. Crust., h. xxxv, t. 18.
Daphnia media, *Koch*, Deutsch. Crust. h. xxxvii, t. 1.
Daphnia ephippiata, *Koch*, Deutsch. Crust., h. xxxv, t. 16.
Puceron branchu, *Trembley*, Mém. pour servir à l'Hist. d'un Gen. de Polypes d'eau douce, 92, t. 6, f. 3 *p*, & f. 11.
Water-flea with branched horns, *Baker*, Emp. for Micros., 302, t. 12, f. 14.
Pou aquatique, *Joblot*, Observ. d'Hist. Nat., i, pt. 2, 105, t. 13, f. P, Q, R.
Le Perroquet d'eau, *Geoffroy*, Hist. abrég. Ins., ii, 655, No. 1.
Vermes minimi rubri, *Merrett*, Pinax Rer. Nat. Brit., 207.
Animaletti aquatici, *Redi*, Osservazioni, t. 16, f. 5; Opere, ii, t. 16, f. 5.

Monoculus, *Bradley*, Phil. Account of Works of Nat., 202, t. 25, f. 5.
Le Puceron verdatre, *Ledermüller*, Mikroskop. Gemüths. Augenergotz., 146, t. 75, f. 2.
Var. α. Daphnia longispina, *Müller*, Entomost., 88, t. 12, f. 8-10.
— *Latreille*, l. c., iv, 226.
— *Bosc*, l. c., ii, 283.
— *Ramdohr*, Beyt. zur Naturg. ein. Deutsch. Monoc. arten, 24, t. 7.
— *Lamarck*, l. c., v. 127.
— *Straus*, l. c., t. 29, f. 23-4.
— *Desmarest*, l. c. 372.
— *M. Edwards*, l. c., iii, 380.
— *Koch*, Deutsch. Crust., h. xxxv, t. 17.
Monoculus longispinus, *Fabricius*, Ent. Syst., ii, 492.
— *Manuel*, l. c., 718, t. 265, f. 5-7.
— *De Geer*, l. c., vii, 442, t. 27, f. 1-4.
— *Schæffer*, Die grün. Arm-Polyp., 59, t. 2, f. 1.

Var. β. Daphnia magna, *Straus*, l. c., t. 29, f. 21-2.
— *Desmarest*, l. c., 373.
— *M. Edwards*, l. c., iii, 380.

The shell or carapace is oval, quite transparent in general, and very finely striated on the anterior and middle portions of the valves, the striæ crossing and interlacing with each other. Sometimes it is of a red colour. The lower extremity of the valves terminates in a sharp spine, which is serrated on its edges. This spine varies in length; in general, in the adult, being short and straight; in some it is a prolongation of the dorsal margin, in others it is directly in the centre, but in the young, and in var. *α*, it is long, and slightly bent backwards. The head is large, rounded on the upper and anterior portion, and produced lower down into a sharp, pointed beak. The superior antennæ are exceedingly small, consisting of only a slight protuberance, and five or six short setæ. The inferior antennæ are very large. The anterior branch consists of four articulations, the first of which is very short. From the extremity of the third, issues a long filament; and from the apex of the fourth, three others arise, of equal length. The posterior branch has only three articulations, all of nearly equal length. From the first and second a long filament is sent forth, and three others spring from the extremity of the third. These filaments are all beautifully plumose, and have a joint at about the middle of their length.* The sixth segment of the body has four projections issuing from it, the first being prolonged, and bent upwards.

The male is much smaller than the female. The superior antennæ are much larger, and spring from under the beak, instead of from the beak itself. The inferior extremities of the valves are more densely serrated than in the female. It is comparatively rarely to be met with.

Hab.—In almost all pools, and ditches of standing water, round London, &c.; common from April to January. Belfast, May 1849, W. Thompson, Esq.

2. Daphnia psittacea. Tab. IX. figs. 3, 4.

Valves of shell, or carapace, oval, transparent, nearly colourless. The head is large, somewhat square-shaped, and the anterior part is beaked like the beak of a parrot. The superior antennæ are short, but larger than in preceding species, and rise from the under surface of the beak. The posterior angle of the shell terminates in a long, sharp point, which is closely serrated on both sides. The margins of the valves are also closely serrated over the greater part of their length, the serræ of dorsal margin extending to near the commencement of the head. The filaments of the antennæ and abdominal lobe are finely plumose. The eye is large.

This species bears considerable resemblance to the *D. pulex*, and at first sight may be easily confounded with it. Upon close examination, however, the form of the head, and the serrated dorsal margin, distinguish it very readily. I procured a few specimens in the beginning of April, along with the *pulex*. All those I detected had the ephippium upon them, and, two or three which I isolated, died very soon after throwing it off. I removed, however, these ephippial ova, placing them in a glass of water by themselves. In about twelve or fourteen days, I had the satisfaction to find the young born from one of these exuviæ; and upon careful examination, I was perfectly satisfied of this being a distinct species, as these young animals resembled, in every respect, their parent. Later in the season, I had opportunities of obtaining adult females with ova, and witnessed the young hatched. These perfectly resembled the adults, in the shape of the head, &c.

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* The number of the articulations, their relative size, and the number and distribution of the filaments of these antennæ, are the same in all the species of the genus Daphnia.

Hab.—Pond on Blackheath; April, June, Sept. 1848.

3. DAPHNIA SCHŒFFERI. Tab. VII, figs. 1, 2; Tab. VIII, figs. A—I.

GESCHWANZTEN ZACKIGER WASSERFLOH, *Schæffer*, Die grünen Arm-Polyp., t. 1, f. 8, 1755.
BRANCHIPUS CONCHIFORMIS PRIMUS, *Schæffer*, Element. Entomol., t. 29, f. 3-4.
DAPHNIA PULEX, *Koch*, Deutsch. Crust., h. xxxv, t. 15.
DAPHNIA, *Rymer Jones*, Outlines of Animal Kingdom, 330, f. 155.
— *Eichhorn*, Beytrage zur Naturg., t. 5, f. H (after Schœffer).

Carapace nearly circular, prominently convex in the centre, and sharply keeled round the circumference posteriorly. Inferior extremity terminated by a long and sharp spine, directed backwards, and finely and closely serrated; the serrations extending upwards along the back, for more than two thirds of its extent posteriorly, and throughout the whole anterior margin. It is quite transparent, of a whitish colour, and shows the body distinctly through it, which in some specimens, in particular localities, is of a fine, light-red colour. The whole surface is finely reticulated, the reticulations being small, and closely set. Near the anterior margin, and at the upper part, the carapace is marked with a series of circular, flat-looking canals (t. VII, f. 1 *a*), which resemble very much the canals described on the carapace of the Apus, and which probably serve the same purpose.

The head is very small, compared with the size of the animal, flattened on the summit, and straight on its front margin, which terminates in a short, projecting beak. On its posterior surface it is marked near the edge with a strong ridge, which appears to commence just above the eye, and runs down to immediately above the heart; while a similar elevated ridge seems to encircle the root of the antennæ.

The eye is of a moderate size, but smaller in proportion than in the *pulex*.

The inferior antennæ are small, compared with the size of the animal, the filaments being finely and densely plumose, but the antennules are well developed, compared with the *pulex;* consisting of a short tubercle, which sends off several short setæ.

The sixth segment of the body sends off five projections; the two posterior being in the form of long spurs, and curved, the points reaching backwards and upwards, the other three being short and obtuse, all finely serrated. The fifth sends off two filaments, which are much shorter, proportionally, than in the two preceding species, but finely plumose.

The abdomen is rather long, broad at the upper part, rather deeply sinuated at about half its length, and narrow towards the extremity. It is beset on the under edge with about fifteen teeth, the sinuation being free from them, and is terminated by two long, curved spines.

The young are very numerous, and I have sometimes counted upwards of thirty born at one accouchement. When the ova are in the ovarium, and even when the young are considerably developed, they present a beautiful, green-coloured mass, showing through the transparent carapace.

This is by far the largest species of the family I have yet seen, being about the fifth of an inch in length, and two lines broad. Their motion through the water is peculiar, being a tumbling, heavy sort of movement, and, when seen in their native ponds, they seem to keep near the bottom. When at the bottom of the vessel in which I kept them, I have frequently seen them turn head-over-heels, throwing a regular summersault, ten or a dozen times in succession. The males I have never yet seen.

The specimens I first procured from Bexley were mostly all grievously infested with the wheel polypi, which had settled in numbers upon all parts of the shell. I placed them, however, when I reached home, in clear fresh water, and shortly afterwards they moulted, or changed their carapace, and thus got rid of their tormenting guests, which afterwards, I have no doubt, became their food. Previous to this change of carapace, the terminal spine was very long, but I observed that in the new shell it became shorter, and more obtuse.

Hab.—Pond on Bexley Heath, Kent, August and September, 1849. Pond at Norwood Green, Middlesex, September 1849.

4. DAPHNIA VETULA. Tab. X, figs. 1, 1*a*.

DAPHNE VETULA, *Müller*, Zool. Dan. Prod., No. 2399, 1776.
DAPHNIA VETULA, *Straus*, Mém. Mus. Hist. Nat., v, t. 29, f. 25-6.
— *Baird*, Ann. Mag. Nat. Hist., i, 255, t. 9, f. 13.
DAPHNIA SIMA, *Müller*, Entomostraca, 91, t. 12, f. 11-12, 1785.
— *Latreille*, Hist. Nat. gén. et part. Crust., iv, 228.
— *Bosc*, Hist. Nat. Crust., ii, 280.
— *Ramdohr*, Beytr. zur Naturg., 18, t. 5-6.
— *Gruithuisen*, Nov. Act. Phys. Med. Acad. Cæsar. Nat. Cur., xiv, pt. 1, 399, t. 24, f. 1-6.
— *Desmarest*, Consid. gén. Crust., 373.
— *Lamarck*, Hist. An. s. Vert., v, 182.
— *M. Edwards*, Hist. Nat. Crust., iii, 382.
— *Koch*, Deutsch. Crust., h. xxxv, t. 12.

Monoculus simus, *Gmelin,* Syst. Nat., 13th edit., i, 3000, No. 25, 1788.
— *Manuel,* Encyc. méth., vii, 723, No. 18.
— *Jurine,* Hist. Nat. Monoc., 129, t. 12, f. 1.
Monoculus lævis, *Fabricius,* Ent. Syst., ii, 492, 1793.
Monoculus exspinosus, *De Geer,* Mem. pour servir à l'Hist. Ins., vii, 457, t. 27, f. 9-11, 1778.
Monoculus conchaceus, *Donovan,* Nat. Hist. Brit. Ins., i, 15, t. 5, f. 1.
Ungeschwanzter-zackiger Wasserfloh, *Schæffer,* Die grün. Arm-Polyp., 229, t. 1, f. 9.
Monoculus nasutus (?), *Jurine,* l. c., t. 13, f. 1.
Monoculus pulex, *Sulzer,* Abgekurzte Geschichte der Insecten, 266, t. 30, f. 10 *e.*
Daphnia congener, *Koch,* Deutsch. Crust., h. xxxv, t. 13.
Daphnia exspinosa, *Koch,* l. c., h. xxxv, t. 11.

The shell or carapace is ovate, transparent, and smaller than in any of the preceding species. It is striated; the striæ being deep, and sometimes crossing, so as to produce a reticulated appearance, especially on the anterior margin, which is furnished with numerous long cilia. The posterior extremity is rounded, slightly serrated, destitute of the spine which marks the preceding species, and is obliquely truncate anteriorly.

The head is obtuse, much smaller than in *pulex,* and the beak less projecting. The superior antennæ are larger than in any of the preceding species, consisting of a stout joint, arising from under the beak, and five short setæ. The filaments of the large antennæ are jointed and plumose, but not so decidedly as in the preceding. The sixth segment of the body has about three small projections from the posterior portion; and near its upper part one longer, like a spur, slightly curved upwards, which serves to hold up, or keep back the ova from falling down beyond a certain distance.

Hab.—Ponds and ditches round London, &c.; common throughout the summer and autumn. Belfast, May 1849, W. Thompson, Esq.

5. Daphnia reticulata. Tab. VII, fig. 5; Tab. XII, fig. 1, male, and fig. 2, var. *quadrangula*.

Monoculus reticulatus, *Jurine*, Hist. Nat. Monoc., 139, t. 14, f. 3, 4.
Daphnia reticulata, *Desmarest*, Cons. gén. Crust., 374.
— *M. Edwards*, Hist. Nat. Crust., iii, 381.
— *Baird*, Trans. Berw. Nat. Club, ii, 148 (*not* Ann. Mag. Nat. Hist.)
Daphnia ventricosa (?), *Koch*, Deutsch. Crust., h. xxxv, t. 21.
Daphnia quadrangula, *Müller*, Entomost., 90, t. 13, f. 4.
— *Latreille*, Hist. Nat. Crust., iv, 227.
Monoculus quadrangula, *Gmelin*, Linn. Syst. Nat., 2999, No. 24.
Monoculus quadrangularis, *Manuel*, Enc. méth., vii, 723, No. 15. t. 265, f. 8-9.
Monoculus quadrangulus, *Fabricius*, Ent. Syst., ii, 492.

The shell or carapace in this species is of a rounded oval shape; the dorsal edge being slightly round, and the anterior bulging out a little inferiorly. The surface is covered with a complete meshwork of small hexagonal cells; and the inferior extremity is provided with a short spine, a little turned backwards.

The head is rather small, and has no beak. It is deeply sinuated at its junction with the body, rising rather erect from that with a projection, and terminating in a blunt, rounded extremity, nearly filled with the eye, which is large and areolar. The filaments of the inferior antennæ are not plumose. The sixth segment of the body is furnished with two projections, and a rather long spur. Ova about four in number. The colour of the shell is slightly greenish.

The ephippium in this species differs considerably from that of the *pulex*. It is more rounded, white in the centre, with a large round ampulla, containing only one ovum (t. XII, f. 2). When the animal has the ephippium on, it possesses a square appearance, and is then the *Daphnia quadrangula* of Müller.

In the month of September 1846 I found many specimens of the male of this species at Highgate and Battersea; and since then I have again found them at Highgate.

The antenna consists of a long, round body, formed of two joints (t. XII, f. 1 *a*) : the first, the smaller of the two ; the second, much larger, cylindrical, and furnished with a short seta on each side. This joint is terminated by a long, sharp spine, which, at about the half of its length, appears jointed. The first pair of feet (t. XII, f. 1 *b*) are exactly the same as in *pulex*. The shape of the shell differs considerably from that of the female, being more oval, less rounded on the dorsal edge, and having the anterior margin straighter.

The head, also, is rather longer, and even more erect than in the female.

Hab.—Ponds and ditches in the neighbourhood of London, Berwick, &c., and commonly met with during all the summer and autumnal months.

6. DAPHNIA ROTUNDA. Tab. X, figs. 4, 4 *a* ; Tab. IX, fig. 6, jun.

DAPHNIA ROTUNDA, *Straus*, Mém. Mus. Hist. Nat., v, t. 29, f. 27, 28.
— *M. Edwards*, Hist. Nat. Crust., iii, 381.
— *Baird*, Trans. Berw. Nat. Club, ii, 148.
DAPHNIA RETICULATA, *Baird*, Ann. Mag. Nat. Hist., i, 257, t. 9, f. 14.
DAPHNIA QUADRANGULA (?), *Koch*, Deutsch. Crust., h. xxxv, t. 19.
DAPHNIA MUCRONATA (?), *Koch*, l. c., h. xxxv, t. 20.
(*Young*) DAPHNIA ANGULOSA (?), *Koch*, l. c., h. xxxv, t. 22.

The shell or carapace in this species is nearly quite round, and the inferior extremity is provided with a short, blunt spine, projecting backwards.

The head is small, depressed, and notched a little above its junction with the body.

The superior antennæ are of moderate size, of a flattened shape, square at the tip, and sending off from its upper edge a short, square branch (t. X, f. 4 *a*), both branches being terminated by several short setæ. The filaments of the large antennæ are not plumose. The surface of the valves is densely reticulated, being covered with a regular network, of small, irregular pentagonal cells. The colour is generally somewhat red. The sixth segment of the body is destitute of the spur which is found in the *reticulata*. The ova are more numerous. The whole animal is larger, and it possesses a greater density of structure.

Hab.—Ponds and ditches in the neighbourhood of London, during summer and autumn.

7. DAPHNIA MUCRONATA. Tab. X, figs. 2, 3.

DAPHNE MUCRONATA, *Müller*, Zool. Dan. Prod., No. 2404, 1776.
DAPHNIA MUCRONATA, *Müller*, Entomost., 94, t. 13, f. 5, 6.
— *Desmarest*, Cons. gén. Crust., 374.
— *Latreille*, Hist. Nat. Crust., iv, 229.
— *Bosc*, Man. d'Hist. Nat. Crust, ii, 281.
— *M. Edwards*, Hist. Nat. Crust., iii, 382.
— *Baird*, Trans. Berw. Nat. Club, ii, 148.
MONOCULUS MUCRONATUS, *Gmelin*, Linn. Syst. Nat., edit. 13th, i, 3000, No. 28.
— *Manuel*, Enc. méth., t. 265, f. 19.
— *Jurine*, Hist. Nat. Monoc., 137, t. 14, f. 1, 2.
MONOCULUS BISPINOSUS, *De Geer*, Mém. servir Hist. Ins., vii, 463, t. 28, f. 3-8, 1778.
— *Fabricius*, Ent. Syst., ii, 493.
DAPHNIA BISPINOSA, *Koch*, Deutsch. Crust., h. viii, t. 1.

This species is readily distinguished by the anterior edge of the shell being quite straight, and terminating inferiorly by a spinous point of considerable length.

The head is of a triangular shape, and the eye is large.

Superior antennæ short.

Filaments of inferior antennæ not plumose.

The back is impressed with a deep indentation at the root of the head; and the anterior margin is marked with brownish coloured bands, and densely ciliated.

The colour of the whole animal is of a dark gray.

The form of the head varies in this species, being sometimes rounded, and at others terminated by a sharp, somewhat curved point directed upwards.

The figure which Müller gives of this species represents the head rounded; that of De Geer, with a sharp point.

Müller says, "variat fronte cornuta, cornu perpendiculariter erecto."

Jurine figures it with the rounded head, and finds fault with De Geer's figure, which, he says, "does not appear to me to be correct, since it presents the nasal prolongation of the shell curved forwards, in place of it being downwards. That of Müller is better in this respect, although it is not perfect."

In the month of August 1841 I found, in the neighbourhood of Isleworth, this species very frequently with the sharp-pointed head; and I observed, that all those which came under my notice having the ephippium upon them, possessed the rounded head. Among them, however, I found several with this form that had young in the ovary, and no ephippium. As in the same pond there occurred many individuals, both with the sharp and the rounded head, and as at the same time they did not vary in any other respect, I can only consider them as varieties.

Var. α. Acute rostrata. Head terminating in a sharp point directed upwards (t. X, f. 3).

Var. β. Obtuse rostrata. Head rounded superiorly (t. X, f. 2).

Hab.—Ponds about Isleworth, &c.; from June to October.

Genus 2—MOINA.

Head rounded and obtuse. Superior antennæ of considerable length, one-jointed, arising from the front of the head, near the centre. Inferior antennæ very large, and fleshy at the base.

1. MOINA RECTIROSTRIS. Tab. XI, figs. 1, 2.

DAPHNE RECTIROSTRIS, *Müller*, Zool. Dan. Prod., 199, No. 2402, 1776.
DAPHNIA RECTIROSTRIS, *Müller*, Entomost., t. 12, f. 1-2.
— *Latreille*, Hist. Nat. Crust., iv, 228.
— *Bosc*, Mém. d'Hist. Nat. Crust., ii, 281.
— *Desmarest*, Cons. gén. sur les Crust., 373.
— *Schrank*, Faun. Boic., iii, 266.
MONOCULUS RECTIROSTRIS, *Gmelin*, Linn. Syst. Nat., 3000, No. 26.
— *Fabricius*, Entomol. Syst., ii, 493, No. 15.
— *Manuel*, Enc. méth., 723, No. 19, t. 265, f. 10-12.
— *Jurine*, Hist. Monoc., t. 13, f. 3, 4.
PASITHEA RECTIROSTRIS, *Koch*, Deutsch. Crust., h. xxxv, t. 24.*
PASITHEA GIBBA (?), *Koch*, l. c., h. xxxvi, t. 16.
DAPHNIA MACROCOPUS (?), *Straus*, Mém. Mus. Hist. Nat., v, t. 29, f. 30.

The shell or carapace of this species is oval, transparent, rounded at the back, and ciliated along the anterior margin.

The head is erect, of considerable size, the inferior extremity rounded, and furnished posteriorly with a very slight spine, or tail.

The antennules are of considerable size, of one joint, flattened, and furnished at the extremity with three or four short setæ. The inferior antennæ are very large, the basal joint stout and fleshy, the branches long and powerful, and the setæ all finely plumose.

The abdomen is emarginated at about half its length, and terminates in two stout, curved spines.

The male is smaller than the female, and is more slender in form. The superior antennæ are very long (t. XI, f. 1 *a*), and apparently consist of two long, flat joints, the terminal one having at the extremity a series of very small hooks. When very young, the male has a long spine at the inferior extremity of the carapace, and the head is much more rounded. As moulting takes place, however, he loses the spine, and the head becomes more elongated.

Hab.—Pond upon Blackheath, October 1849.

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* The genus *Pasithea*, having been used in zoology twice previously, cannot be retained.

2. Moina brachiata. Tab. IX, figs. 1, 2.

Monoculus brachiatus, *Jurine,* Hist. Monoc., 131, t. 12, f. 3, 4.
Daphnia brachiata, *Desmarest,* Cons. gén. Crust., 373.
— *M. Edwards,* Hist. Nat. Crust., iii, 383.
— *Baird,* Zoologist, i, 196, fig. at p. 193; Trans. Berw. Nat. Club, ii, 148.

The length of this little creature is about half a line. The shell or covering is of an olive colour, transparent, showing the stomach and intestine very plainly. It bulges out very much posteriorly, giving the animal a very *jolly* appearance, and is ciliated anteriorly.

The superior antennæ are large and long, projecting straight out from the beak, somewhat cylindrical in shape, giving off from their upper margin one or two small spines, and terminated by several short setæ. The main stalk, or basilar joint of the inferior antennæ, is very large, and fleshy-looking; the under edge, for about half its length from the base, being crenated, and having two short setæ springing from one of the crenations, or small lobes, at about the middle of its length; the upper edge also is crenated. The articulations of the branches are somewhat serrated on the edges, and the long setæ with which they are furnished are all finely plumose, and jointed about the middle of their length.

The abdomen has at its extremity eight short spines on the inner edge, and two long, stout claws. The two setæ on the seventh joint of body are long, plumose, and jointed.

This species is not so active as some others of this genus, owing perhaps partly to the form. It has a great many ova.

Hab.—I first found this species in a stagnant pool in old St. Pancras road, London, nearly opposite old St. Pancras Church, in the summer of 1844. Since then, the pool in which it occurred has been built over. Pond on Blackheath, June 1848.

Genus 3—MACROTHRIX.*

MACROTHRIX, *Baird*, Ann. Mag. Nat. Hist., xi, 87, 1843, and xvii, 412; Trans. Berw. Nat. Club, ii, 149.
DAPHNIA, *M. Edwards*, Hist. Nat. Crust,, iii, 384.
— *Müller* (?), Entomost.
LYNCEUS, *Desmarest*, Cons. gén. et part. Crust., 376.
MONOCULUS, *Jurine*, Hist. Monoc. Genève.
ACANTHOCERCUS, *Schödler*, Erichs. Archiv, 1846.

Character.—Superior antennæ flat, one-jointed, pendulous from the beak. Filament from extremity of first joint of anterior branch of inferior antennæ much longer than any of the others. Eye accompanied with a black spot.

1. MACROTHRIX LATICORNIS. Tab. XV, fig. 2.

DAPHNIA CURVIROSTRIS (?), *Müller*, Entomost., t. 13, f. 1, 2.
MONOCULUS LATICORNIS, *Jurine*, Hist. Monoc., t. 15, f. 6.
LYNCEUS LATICORNIS, *Desmarest*, Cons. gén. part. Crust., 376.
MACROTHRIX LATICORNIS, *Baird*, Ann. Mag. Nat. Hist., xi, 87, t. 2, f. 9, 10; Trans. Berw. Nat. Club, ii, 149.
ACANTHOCERCUS CURVIROSTRIS (?), *Schödler*, Erichs. Archiv, 1846.

The shell or carapace is of an oval shape, transparent, colourless, smooth, strongly ciliated on anterior margin.

The inferior antennæ or rami are strong and large (t. XV, f. 2 *a*). The posterior branch has four setæ; three from the extremity of the last articulation, and one from the extremity of the second. The anterior branch has five setæ, four disposed as in the posterior branch, and one very long, from the extremity of first articulation. Superior antennæ pendulous from the extremity of the beak, rather broad, becoming narrower at their base, and furnished with three short setæ at their extremities.

Eye large, distinctly areolar, and having an accompanying black spot near the root of the superior antennæ.

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* Μακρος, long; and θριξ, a hair.

Intestine straight, not convoluted; but more distinctly curved at its upper extremity than in the other Daphniadæ.

Hab.—Pond at Southall, Middlesex, June 1841; Sept. 1849. Pond at Highgate, July 1842; Sept. 1849. Belfast, May 1849, W. Thompson, Esq.

2. MACROTHRIX ROSEUS.

MONOCULUS ROSEUS, *Jurine*, Hist. Monoc., t. 15, f. 4, 5.
LYNCEUS ROSEUS, *Desmarest*, Cons. gén. et part., 376, t. 54, f. 8-9.
DAPHNIA ROSEA, *M. Edwards*, Hist. Nat. Crust., iii, 384, No. 14.
— *Yarrell*, British Fishes, ii, 93, vignette.
MACROTHRIX ROSEUS, *Baird*, Trans. Berw. Nat. Club, ii, 149.

This species differs very little from the preceding. The shell or carapace is smooth, and very transparent; anteriorly it is ciliated. The superior antennæ are longer and narrower than in *laticornis*, and are furnished with three very short setæ at their extremity. The eye is considerably smaller, and has no areola round it. The colour of the whole animal is of a rosy hue. Eggs two.

It swims horizontally; and when it bounds through the water, the motions of its arms are soft and graceful. It forms great part of the food of the Vendace (*Corregonus Willughbii*).

M. Edwards considers this and the preceding to be the same species.

Hab.—Lochmaben Loch, Dumfriesshire, Sir W. Jardine, Bart., W. Yarrell, Esq.

As I have not seen this species, I have not figured it. It may turn out to be only a variety of the preceding, if not exactly the same.

Genus 4—BOSMINA.*

DAPHNIA, *M. Edwards, Desmarest, Baird.*
MONOCULUS, *Jurine.*
LYNCEUS, *Müller, Latreille.*
BOSMINA, *Baird,* Trans. Berw. Nat. Club, 1845; Ann. Mag. Nat. Hist., xi, 412.

Character.—Superior antennæ long, curved, cylindrical, consisting of many small articulations, and projecting from the extremity of the beak. Inferior antennæ small compared with preceding genera.

1. BOSMINA LONGIROSTRIS. Tab. XV, fig. 3.

LYNCEUS LONGIROSTRIS, *Müller,* Zool. Dan. Prod., No. 2394; Entomost., 76, t. 10, f. 7, 8.
— *Latreille,* Hist. Nat. Crust., iv, 206.
— *Fabricius,* Ent. Syst., ii, 499.
MONOCULUS CORNUTUS, *Jurine,* Hist. Nat. Monoc., 142, t. 14, f. 8-10.
DAPHNIA CORNUTA, *Desmarest,* Cons. gén. Crust., 375.
— *Baird,* Ann. Mag. Nat. Hist., ii, 257, t. 9, f. 15.
— *M. Edwards,* Hist. Nat. Crust., iii, 382.
BOSMINA CORNUTA, *Baird,* Trans. Berw. Nat. Club, ii, 149.
BOSMINA LONGIROSTRIS, *Baird,* Ann. Mag. Nat. Hist., xvii, 412.
EUNICA† LONGIROSTRIS, *Koch,* Deutsch. Crust., h. xxxv, t. 23.

This animal is very small. The shell or carapace is rounded on the posterior margin, bulging out anteriorly, and terminating at the inferior angle in a sharp point or spine, which projects straight downwards. The superior antennæ consist of twenty articulations; the first seven are short and close to each other; at the seventh two or three setæ spring, projecting forwards and upwards; then follow thirteen articulations, each one longer than the preceding. It requires a strong magnifying power to make out this articulated structure distinctly. Like the antennules of the Daphniadæ and Lynceidæ, they appear to be almost destitute of motion, and thus when seen close to each other, they certainly bear a close resemblance to a prolongation of the beak. The inferior antennæ, though strong bodies, are much shorter than in most of the Daphniadæ. The anterior branch has four articulations; the posterior only three. They are furnished with long filaments, which are not plumose. The ova are few in number.

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* "Bosmina," a daughter of Fingal.

† As the terms EUNICE and EUNICAE have been already used in zoology, and as this genus is not characterised by Koch, I have preferred retaining the name I applied to it in 1845.

The motion of this curious little creature through the water is caused by numerous and very rapid strokes of its inferior antennæ or rami, being in that respect very similar to the Lyncei. The males I have never met with.

Hab.—New River, London; Highgate ponds. I have every summer for several years past met with it abundantly in the common drinking-water of London supplied from these two sources.

SIDINA.

Genus 1—SIDA.

SIDA, *Straus*, Mém. Mus. Hist. Nat., v; *M. Edwards, Baird, Dana.*
DAPHNIA, *Müller, Latreille, Bosc,* &c.
MONOCULUS, *De Geer, Jurine,* &c.

Character.—One branch of inferior antennæ with three, the other with two articulations, large and powerful. Superior antennæ of moderate size.

1. SIDA CRYSTALLINA. Tab. XII, figs. 3, 4; Tab. XIII, fig. 1 *a-h*.

DAPHNE CRYSTALLINA, *Müller*, Zool. Dan. Prod., No. 2405, 1776.
DAPHNIA CRYSTALLINA, *Müller*, Entomost., 96, t. 14, f. 1-4.
— *Latreille*, Hist. Nat. Crust., iv, 230.
— *Bosc*, Mém. d'Hist. Nat. Crust., ii, 281.
SIDA CRYSTALLINA, *Straus*, Mém. Mus. Hist. Nat., v.
— *M. Edwards*, Hist. Nat. Crust., iii, 385.
MONOCULUS CRYSTALLINUS, *Gmelin*, Linn. Syst. Nat. edit. 13th, i, 3000, No. 29.
— *Manuel*, Enc. méth., vii, 724, t. 265, f. 15-18.
— *Fabricius*, Ent. Syst., ii, 493.
MONOCULUS ELONGATUS, *De Geer*, Mém. servir Hist. Ins., vii, 470, t. 29, f. 1-4, 1778.

Carapace or shell elongate-ovate, very transparent, truncate at inferior extremity. Head (t. XII, f. 3 A) large, with a projecting plate at the posterior part (f. 3 A, *q*). Eye large and round (t. XII, f. 3 *b*, 3 A, *c*). Body within the carapace very narrow, nearly straight.

Abdomen has at the bend a projecting knob, with two long setæ proceeding from it, and terminates in two long, stout claws, each of which has three spines on its inner edge (t. XIII, f. *h*). Between the knob and the terminating claws the inferior edge is beset with two rows of about twenty short spines.

The superior antennæ (t. XIII, f. *a*) are rather large and long, and armed at extremity with four short spines. They spring from a knob or eminence projecting a little out from the edge of the shell. The inferior antennæ or rami are large (f. *b*). The basal joint is very stout and rounded, more than a third the length of the whole organ, and furnished with three short spines on anterior extremity. The two branches are rather short, compared with the size of the basal joint and the size of the animal. The external branch is divided into three articulations. The first, or lowest, is very short, and has a small spine at the outer angle; the two others are nearly of equal length.

The second has three plumose setæ springing from its inner edge, each arising from a small projection, and furnished with a joint about the middle of their length; and one short simple spine from outer angle at the anterior extremity. The third has seven similar setæ, four on the inner edge, and three at the extremity, besides one short simple spine at the outer angle. The inner branch has only two joints, the first much the longer of the two, and having at its extremity or inner edge one short simple spine, and one long seta, the second or terminal very short, and having four long plumose setæ from its upper edge.

The mandible (t. XIII, f. *c;* t. XII, f. 3 A, *f*) is similar to that of *Daphnia Schæfferi*, and has a row of cutting teeth on its edge. The labrum (t. XII, f. 3 A, *g*) is like that of Daphnia, and is provided with a strong muscle. The intestinal canal is large. The œsophagus is in form of a narrow, slightly-curved canal, which terminates a little below the eye in a large *cul-de-sac*, the commencement of the stomach (t. XII, f. 3 A, *e*). There does not appear to be any organ corresponding to what has been described in Daphnia as the *cæcum*. The feet are six pairs in number, and differ from those in the Daphnina, and also from each other. The first pair (t. XIII, f. *d*) consists of a main stalk of two articulations, one of which has four setæ, the other seven. From the inner edge springs a large branchial plate provided with about thirty filaments, and from its upper part a smaller plate arises furnished with nine or ten short filaments, and one longer and plumose. The four succeeding pairs are more like each other, but differ somewhat from the first pair. They each (t. XIII, f. *e*, *f*) possess a small triangular plate fixed upon the edge of the main stalk, and taking the place of the setæ which are found in the preceding. The smaller branchial plate is shorter, broader, and square-shaped, and the branchial filaments of both plates are shorter. The sixth pair (t. XIII, f. *g*) differs from all the others. Each foot consists of three articulations, each furnished with several strong setæ, and the whole organ presents a curved appearance. In full-grown females (t. XII, f. 3) the ovary contains upwards of twenty young, and the animals then present a different appearance from those which have no ova (t. XIII, f. 1). The young resemble the parent from their birth. Twenty-four hours after being born they appear as represented in t. XII, f. 4.

The motion of the Sida through the water is a sort of rapid running movement. They are generally inactive, and adhere in a peculiar manner by the back of their head to the side of the vessel in which they are contained, remaining there for hours. They adhere most probably in the same way to the weeds in the water where they are found, as it is by skimming the stems of the weeds that they are detached and caught. They do not appear to be numerous in the localities in which I have found them, and indeed are of rare occurrence.

Hab.—Back fishpond at Overstone Park, Northamptonshire, July and August, 1849; ditch near Richmond, opposite Isleworth, August, 1849; found near Dublin, by Professor Allman, W. Thompson, Esq., July 1848.

Genus 2—DAPHNELLA.

Inferior antennæ very large; both branches consisting each of only two articulations.

1. DAPHNELLA WINGII. Tab. XIV, figs. 1-4.

Carapace elongated, rounded at the back, slightly curved at inferior extremity, and having a small mucronation, somewhat truncated in front, and of a beautiful, clear, crystalline transparency.

The head is long and narrow.

Eye (t. XIV, f. 4 *c*) large, round, composed of upwards of forty crystallines, and nearly filling the upper part of the head.

Superior antennæ (f. 4 *b*) long and rather slender, and provided with two setæ at their extremity, of considerable length. Inferior antennæ or rami very large and powerful; the basal joint is particularly so, and fleshy-looking; the two branches are also large, and each divided into two articulations. Both articulations of posterior branch are nearly of equal size, the inferior having three and the upper eight long filaments springing from their inner edge. These filaments are not plumose, but are jointed at the middle of their length. The joints of the anterior branch are of unequal length, the first being long, and furnished with only one filament; the second being very short, and sending off three long setæ from its upper edge.

The mandible (f. 4 *f*), labrum (f. 4 *g*), œsophagus (f. 4 *o*), and stomach (f. 4 *a*) are almost exactly the same as in Sida.

The abdomen consists of a broad plate, with large knob and two long setæ, and has two rows of short spines on its edge, as described in preceding genus.

The feet also resemble those of Sida, and are six pairs in number.

The male (t. XIV, f. 2) is smaller than the female, and is beautifully transparent. The antennules (f. 2 *a*) are long, with a tooth on the upper edge, about the middle of their length, and three long setæ at their extremity. The abdominal plate (f. 2 *b*) appears to have a supplemental plate, which covers it, and which is flat, broad, and curved at the lower extremity.

The female has very few young, only two or three.

The motion of this beautiful little animal is by sudden bounds, darting forwards, by means of its large rami, for a great distance at each bound.

Hab.—Pond on the edge of the Colne, between Twickenham and Whitton, Middlesex, July 1841; ditch near Richmond, opposite Isleworth, July 1841, August 1849.

Family 2—POLYPHEMIDÆ.

Polyphemidæ, *Baird*, Trans. Berw. Nat. Club, ii, 149, 1845.
— *Dana*, Proc. Amer. Acad. Arts and Sc., 1849.

Character.—Four pairs of feet, not contained within the shell. Eye very large. Inferior antennæ two-branched, one branch having four, the other three articulations. Lower part of shell forming a large vacant space, for containing the ova and young.

This family contains two British genera, Polyphemus and Evadne.

Genus 1—Polyphemus.

Polyphemus, *Müller*, *Cuvier*, *Latreille*, *Straus*, *Edwards*, &c.
Monoculus, *Linnæus*, *Geoffroy*, *De Geer*, *Fabricius*, *Jurine*, &c.
Cephaloculus, *Lamarck*, *Bosc.*

Character.—Head distinct from body. Abdomen long, projecting externally from the shell.

1. Polyphemus pediculus. Tab. XVII, fig. 1.

Monoculus pediculus, *Linnæus*, Faun. Suec., No. 2048, 1746; Syst. Nat., edit. 10th, i, 635, No. 5; edit. 12th, i, 1058, No. 5.
— *Gmelin*, Linn. Syst. Nat., edit. 13th, i, 3001, No. 5.
— *Fabricius*, Ent. Syst., ii, 502; Sp. Ins., i, 374, No. 7; Mantissa Ins., i, 240, No. 7.
— *Sulzer*, Insecten, t. 30, f. 8 *a*.
— *Manuel*, Encyclop. méth., vii, 718, t. 263, f. 1.
Monoculus pediculus ramosus, *De Geer*, Mém. pour serv. à l'Hist. Ins., vii, 467, t. 28, f. 9-13, 1778.
Polyphemus oculus, *Müller*, Zool. Dan. Prod., No. 2417, 1776; Entomost., t. 20, f. 1-5.
— *Cuvier*, Tab. élément., 456.
— *Latreille*, Hist. Nat. Crust., iv, 287; Genera Crust. et Ins., ii, 20.
— *Leach*, Edin. Encyc., art. Crustaceology.

Polyphemus stagnorum, *Leach,* Dict. Sc. Nat., xiv, 540.
— *Latreille,* Cuv. Règ. An., iv, 165.
— *Desmarest,* Cons. gén. Crust., 365, t. 54, f. 1.
Polyphemus pediculus, *Straus,* Mém. Mus. d'Hist. Nat., v.
— *M. Edwards,* Hist. Nat. Crust., iii, 389.
Monoculus polyphemus, *Jurine,* Hist. Nat. Monoc., 143, t. 15, f. 1-3.
Cephaloculus stagnorum, *Lamarck,* Hist. An. s. Vert., v, 131.
— *Bosc,* Man. d'Hist. Nat. Crust., ii, 247.
Le Monocle à queue retroussée, *Geoffroy,* Ins. Par., ii, 656, No. 2.
Monoculus oculus, *Gmelin,* Linn. Syst. Nat., edit. 13th, i, 2996, No. 10.
Scalicerus pediculus, *Koch,* Deutsch. Crust., h. xxxvii, t. 2.

The body is oval-shaped, separated from the head by a deep indentation.

The upper part of the head is almost entirely occupied with the eye, which is provided with its rotatory muscles, as in the Daphniadæ, and is beset, all round the upper and outer edges, with numerous lucid areolæ, about twenty in number. The lower part is quite transparent, the black mass filling only about three fourths of the whole.

The mandibles are almost exactly the same as in the Daphnia.

The inferior antennæ or rami (t. XVII, f. 1 *a*) are large, and divided each into two branches. The anterior branch has three articulations: the first the largest; the second is the shortest; and the third is the longest and the most slender. The first joint has one seta, the second one also, and the third has two from the side, at equal distances from each other, and three from the apex. The posterior branch has four articulations, one very short and three longer. The second joint has one seta at its extremity; the third has one springing from the middle of the articulation, and one from the extremity. The last joint has one seta on its edge, and three at its extremity. The setæ are jointed at about half the length.

The superior antennæ are small, arising from the edge of the head below the eye; they are sharp-pointed, and terminate in two or three fine setæ, directed upwards.

The intestine is curved, but not convoluted.

The body of the animal is only partially inclosed within the shell. It is fleshy, and after descending in it about two thirds of its length, turns upon itself from behind forwards, and folds itself suddenly backwards, to form a long and slender tail, which projects from the shell, and protrudes externally, extending fully the length of the carapace. It is serrated on the outer edge, and terminates in two long setæ. This organ differs very much from that of the Daphniæ, and, as Jurine says, seems to serve as a rudder.

The heart is situated at the same part of the body as in the Daphniæ, near the junction of the head and body.

The lower part of the shell seems to be the matrix or receptacle for containing the ova, which are generally about six in number.

The legs (t. XVII, f. 1 *b*) are four pairs, always projecting from the shell externally. They are four-jointed, and provided at the extremity of the last joint with several plumose setæ. The fourth pair are shorter than the others, and want these setæ. These organs resemble more the legs of the *Cyclopidæ* than the other animals of this family, and are, in accordance with their structure, used by the Polyphemus for swimming. It always swims upon its back, and generally horizontally, with quick repeated motions of the antennæ and legs, which carry it rapidly through the water.

Like the Daphniæ, the Polyphemus has, at particular seasons, the ephippium, or saddle, which serves exactly the same purpose as in them. The number of young is not so great as in the Daphniæ, seldom reaching, at the most, to the number of ten, but more frequently about six. It is very difficult to make accurate observations on the manners and habits of living and propagating their species in this genus, as the little animals are very difficult to be kept in captivity. In the young, even when in the matrix, it is particularly observable, that the eye very soon makes its appearance, an organ so large in the adult, that Müller says "its head is all eye."*

The males have never yet been noticed by any observer.

Hab.—Ditch near Richmond, on the banks of the Thames, nearly opposite Isleworth, July. It seems to be very limited in its range of habitat, for though this ditch is frequently filled by the tide from the river, and is fully a mile in length, I have only found it in one spot, not much above twenty yards in extent.

Genus 2—EVADNE.

EVADNE, *Loven*, Zoologisk. Bidrag., p. 1.
— *M. Edwards*, Hist. Nat. Crust., iii, 390.
— *Goodsir*, Edin. Phil. Journ., xxxiii, 366.

Character.—Head not distinct from the body. Abdomen short, scarcely projecting from the shell.

1. EVADNE NORDMANNI. Tab. XVII, fig. 2.

EVADNE NORDMANNI, *Loven*, Zoologisk. Bidrag., t. 1, 2; Do., Kongl. Vetenskaps. Acad. Hadlingar., t. 1, f. 1-8.
— *M. Edwards*, Hist. Nat. Crust., iii, 390, t. 36, f. 7.
— *Goodsir*, Edin. Phil. Journ., xxxiii, t. 6, f. 15, 16.

The whole animal is almost colourless, except the posterior part of the eye, which is black. The anterior portion is much the larger, and deeply ribbed longitudinally.

Antennæ composed of two branches. A number of long setæ spring from the extremity of each.

The legs (t. XVII, f. 2 *a*) are four pairs, and arise almost immediately below the eye. They are each composed of four articulations, which are all furnished with several strong setæ. A powerful muscle extends from the legs, and passing upwards immediately behind the eye, is attached to the dorsal portion of the shell. The whole of the internal cavity of the shell immediately behind the muscle is apparently empty, except at the season of spawning, when it is full of ova or young.

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* "Caput totum oculus."—Entomost., 118.

The posterior part of the body is produced in the middle into a strong, pointed spine.

The feet are much thicker than those of the Daphniæ, and the construction of these organs appears to establish a passage from the Cladocera to the Copepoda.

The habits of this animal are extremely active, and very similar to those of the Daphniæ. They form part of the food of the herring.

Hab.—Firth of Forth; H. Goodsir.

Family 3—LYNCEIDÆ.

LYNCEUS, *Müller, Latreille, Manuel, &c.*
DAPHNIDES (in part), *Straus.*
DAPHNIDIENS (in part), *M. Edwards.*
DAPHNIDÆ (in part), *Baird,* Ann. and Mag. Nat. Hist., ii.
LYNCEIDÆ, *Baird,* Trans. Berw. Nat. Club, ii, 150, 1845.

Character.—Two pairs of antennæ; superior, very short; inferior, of moderate size, branched; each branch divided into three articulations. Feet five pairs. Eye single, but accompanied with a black spot in front of it. Intestine convoluted, having one complete turn and a half. Abdominal portion of the body jointed.

Bibliographical History.—Müller established the genus Lynceus in his 'Zool. Dan. Prod.,' in 1776, and so named it, from its having, according to his idea, two eyes. Previous to this time no author had ever taken notice of any species belonging to it. In 1781 he confirmed the genus, in his work on the 'Entomostraca;' described nine species, and gave a few particulars regarding them.

About the same time Schrank and Eichhorn simultaneously mention an insect which evidently belongs to this genus, and which may probably be only one and the same species. The first of these two authors, in his 'Enum. Insect. Austriæ,' 1781, p. 536, No. 1119, describes it briefly as "Monoc. infusorius, testa bivalvi, rostratus, oculis duobus in rostro sitis," and says it is very abundant in stagnant waters, and is perhaps the smallest of its congeners. Eichhorn gives a figure of his insect, says it is distinguished from that "Wasserfloh" described by Schœffer (Daphnia), inasmuch as it has a pointed beak which lies close upon the mouth; that it differs from it in its motion through the water, not by bounds, but swimming like other insects, and that it is exceedingly common.* These authors give little satisfactory information, however, respecting the genus; and Müller's characters are very indifferent, as will be shown more clearly hereafter. His species, without any original matter, are given by Gmelin, in his 'Syst. Natur. Linn.,' 1778; Manuel, in the 'Encyc. méth.,' 1792; Fabricius, in his 'Entom. Syst.,' 1793; Latreille, in his 'Hist. gén. et part. des Crust. et Ins.' 1802; and Lamarck, in his 'Hist. Nat. des Anim. s. Vertèb.' 1818: but no new species are added.

Leach is the only British naturalist that has particularly noticed the genus Lynceus. In the Supplement to the 'Encyc. Britann.,' art. Annulosa, 1816, and in the 'Dict. des Scien. Nat.' xiv, 541, 1819, he appears to have been sensible that it was ill formed, and splits it into two; but with the exception of this, we have nothing new written upon the genus until Jurine published his 'Hist. des Monoc.,' in 1820. In this work he has given us a few particulars with regard to the question of their having two eyes, the mode of reproduction, &c. He notices several of Müller's species, describes three or four new ones, and hints at the necessity of reforming the genus altogether. These additional species are given, along with those of Müller, by Desmarest, in his 'Consid. gén. sur les Crust.,' 1825; but we have no new information till Milne Edwards published his work on the Crustacea in 1840.* In this work the author shows the necessity for breaking down this heterogeneous genus, and reforming it; but he does not make the attempt himself, nor do I know of any attempt having been made before I published my paper on the Lynceus, in the 'Annals and Magazine of Natural History.'

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* Beyt. zur Naturg., p. 37, t. 3, f. D; 1781.

Anatomy and Physiology, &c.—In general formation the animals of this family are very much like the Daphniadæ; the most remarkable points of difference being the shape of the head and beak, and a small black spot a little distance from the eye, much smaller than it, which is considered by Müller as a second organ of vision, and from which he has given the name to the genus.† The shell or covering which incloses the body does not consist of two distinct and separate valves, but is open only on the anterior margin, and for a portion of the posterior extremity. The part which we may call the head is harder than the other portion of the shell, and is prolonged in most of the species into a sharp and very distinct beak. Belonging to it we find, besides the beak, the eye with its accompanying black spot, the superior antennæ, the inferior, or rami, the brain, mouth, and part of the digestive canal.

The eye (t. XV, f. 1 *l*), as in the Daphniadæ, is a spherical body contained in a somewhat funnel-shaped sheath of muscles, having a semirotatory motion, and consisting of a series of crystalline bodies; which, in the *Eurycercus lamellatus*, are about twenty in number.

The black spot, which Müller considers as a second eye, is situate before, and at a little distance from, the real eye, generally near the end of the beak, almost at the extremity of the body of the animal, and near the root of the antennæ. It is much smaller than the eye, has no communication with it, and is immoveable. It is not composed of crystallines, and its situation is not exactly the same in all the species.

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* Hist. Nat. des Crust., vol. iii.

† "Nomen Lyncei in Zool. Dan. prod. ex punctis binis ocellaribus, quæ organa visus absque dubio sunt, indixi."—Entomost., p. 67.

Jurine says he has only examined it in small individuals, and that in consequence he has not been able to discover its utility. He does not appear to have met with the larger individuals of this family, such as the *Eurycercus lamellatus,* in which I have examined this spot, but without being able to ascertain any use to which it is applied. I quite agree with him, however, in considering it to be *not* an organ of vision.

Straus considers the upper larger spot the only one deserving the name of eye, and this small black spot to be similar to that existing in the Daphniadæ adjacent to the brain, the relative situation of which is also nearly the same as this black spot in the Lynceidæ. We find it in the young before birth exactly as in the adult.

The antennæ are four in number, two superior and two inferior, and are situate as in the Daphniadæ. The superior antennæ (t. XV, f. 1 *a*) consist each of a solid body, of a somewhat conical shape, and slightly curved, which terminates in six short spines, each of which again gives out a fine seta or bristle. They are not possessed of much motion. The inferior antennæ, or rami as they are sometimes called (t. XV, f. 1 *b*), are situate on each side of the base of the head, rather lower than in the Daphniadæ, and consist, as in them, of a single joint at the base, which divides into two branches, each having three joints; they are much shorter in all the species than in the Daphniadæ. In the *Eurycercus lamellatus* the anterior branch sends off from the last joint three long filaments or bristles, and a short one, and one from the extremity of the second and first joints; while the posterior branch sends off only three long ones and a short one from the last joint. The long setæ are each furnished with a joint near the centre, as in *Daphnia pulex,* and, as in it, are beautifully plumose, while the short setæ are neither jointed nor plumose.

The use of these organs is the same as in the Daphniadæ, being chiefly organs of locomotion.

The brain is apparently the same in situation and in shape as in the Daphniadæ. The mouth also is nearly of the same construction.

The mandible (t. XV, f. 1 *c*) is a strong organ, articulating superiorly with the body by a sharp and pointed extremity, whilst the inferior extremity is free and unattached, curved a little inwards, and rounded somewhat at the tip, which is furnished with several strong teeth.

The labrum (t XV, f. 1 *d*) consists of a large, strong plate, articulating wiih the body by the narrow end, to which are attached the muscles which move it. About the centre of its length it takes a sudden curve, and descends in the form of a broad plate, which is slightly lunated at the extremity, the edges terminating in sharp points. To the lower edge of its superior extremity is attached a flat, rather square plate, which moves simultaneously with the other part, and to which it seems firmly fixed. These organs may be seen almost constantly in motion when the animal is stationary, the motion of the mandibles being pretty quick and oscillatory, whilst that of the labrum is slow, upwards and downwards.

The jaws consist of a flat body, armed at the extremity with several stout spines (t. XV, f. 1 *d**).

Part of the digestive canal may be seen also in the upper part of the animal, commencing, as in the Daphniadæ, immediately behind the mouth, in the form of an œsophagus, and terminating in the stomach, which is situate in the lower portion of the shell.

The stomach (t. XVI, f. 1 *b*) differs somewhat from that organ as seen in the Daphniadæ, being curved or twisted into one or two complete convolutions near the centre.

The body of the animal is not jointed, as in the Daphniadæ, and is quite free and unattached within the valves of the shell, except at the superior portion, where we see it attached to the posterior edge of the shell by about three rather broad muscles. It terminates superiorly in a point near the root of the antennæ, and almost upon the extremity of this point is situate the black spot in front of the eye. A short distance from this the body has an indentation, in which, or rather on its edge, is situate the eye, already described. It then takes a round turn, the edge of which is more or less crenated, and from it the muscles attaching the body to the shell arise. It now turns inwards for a short distance, and then bulges outwards again towards the posterior edge, terminating by a joint in the abdomen.* The space left where the body turns inwards, between it and the shell, is the matrix, or place where the animal deposits its ova, and where the young remain till ready to be extruded; and immediately above this is situate the heart.

The abdomen (t. XV, f. 1*k*) in all the species I have examined is connected to the body by an articulated joint, differing in this very particularly from the Daphniadæ. At this joint we see two setæ arise, which in some species, as in the *Eurycercus lamellatus*, are beautifully plumose, and of considerable length. The abdomen is then projected upwards, being always within the shell when the animal is at rest. It terminates in two or more hooks, the use of which seems to be to assist in cleaning the interior of the shell, as the abdomen is flexible, and can be extended at pleasure to a considerable extent beyond the carapace. In one or two species it is remarkably long, as in the *Camptocercus macrourus*, and is extremely flexible, the motion of this organ being evidently of great use to the animal in assisting and regulating its movements. A little beyond this joint is placed the anus, or termination of the alimentary canal.

The feet are five pairs in number (t. XV, f. 1 *e-i*); the first pair are the largest, and consist each of a fleshy sort of body, bent a little, strongly ciliated on its upper edge, and furnished at its extremity with five long and strong setæ, which in general project a little beyond the edge of the valves. The other feet, from their extreme delicacy of structure and transparency, are difficult to be made out; but they closely resemble those of the Daphniadæ, consisting of branchial plates and finely plumose setæ, and have the same functions and uses.

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* The body, as above described, is particularly well seen in the *Acroperus harpæ*.

These insects are found in stagnant waters and slow-running streams, amongst the Lemnæ and Confervæ which collect in those situations. The males have not been met with or described, though two, three, and even four may often be seen fixed to each other, and swimming about in that state.* Several species are very abundant throughout the spring, summer, and autumn, and may be met with in almost every pond and ditch. They are not, individually, however, so prolific as the Daphniæ, as they produce only a few eggs at a time, generally two or three, with the exception of the *Eurycercus lamellatus*, which has nearly as many as the *Daphnia vetula*, and is about the same size. Their mode of reproduction is the same as in the Daphniadæ, the intervention of the male more than once not being necessary for fecundating the eggs of the female. In one species, the *Chydorus sphæricus*, Jurine obtained, by isolating the young successively, *fifteen* generations; and in the *Alona quadrangularis*,† he followed up the moultings and generations for *nine* successive periods. On the 7th of June he isolated a female, which had eggs; 8th June, two young ones born; 9th, it has moulted, and got two eggs of a clear brown colour; 11th, eggs are elongated, eye visible; 13th, a second accouchement has taken place; 14th, has moulted, and has two eggs; 17th, a third accouchement; 19th, has moulted, and has three eggs; 20th, a fourth accouchement; 21st, moulted, and has two eggs; 22d, a fifth accouchement; 23d, moulted, and has two eggs; 25th, a sixth accouchement; 26th, moulted, and has two eggs; 28th, a seventh accouchement; July 3d, moulted, and has two eggs; 8th, an eighth accouchement; 9th, moulted, cannot exactly determine whether it has eggs, the insect is yellow; 11th, moulted, cannot see eggs; 14th, ninth accouchement, young ones dead; 15th, mother herself is dead.* The young are born perfect; and even before they are ushered into the world, whilst still in the matrix, we discover the eye and its accompanying black spot. These insects are said by Jurine to be subject, like the Daphniadæ, to the saddle or ephippium, and he asserts that in each ephippium there is only one egg, which is placed in the middle of the saddle, and makes a projection from it. I have never myself met with an individual having the saddle; and in general I have found those which I have kept very short-lived as compared with the Daphniadæ. The motion of these insects through the water is somewhat different from that belonging to the Daphniadæ. Instead of swimming by short irregular bounds, as these latter do, they direct themselves by a rapid motion of their inferior antennæ, or rami, and legs, straight towards the point to which they wish to go. This was noticed by Eichhorn, as already mentioned, who seems to be the only person who remarks it till the time of Jurine; and it appears chiefly perhaps to depend upon the comparative shortness and position of the rami, for the *Bosmina longirostris*, which has also very short rami, situated as in the Lynceidæ, has the same kind of motion.† The food of the Lynceidæ consists of both animal and vegetable matter, and while they prey upon animalcules smaller than themselves, they, in their turn, are devoured in great numbers by insects larger than they are. According to Pritchard, the *Chydorus sphæricus* is the choice food of a species of fresh-water Nais, which he calls the Lurco. "So great is the voracity," he says,* "of this creature, that I have seen a middle-sized one devour seven Lyncei in half an hour. Five of these were moving about in the first cavity, at the end of that time the other two, having passed into the second, had become exhausted."†

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* In the Bulletin of the 'Ann. de la Soc. Entomol.,' February 1837, p. 11, M. Audouin communicated the fact of his having had several specimens of a species of Lynceus from the neighbourhood of Warsaw, sent to him by the celebrated Waga, and that he had ascertained the existence of male specimens amongst them. He contemplated publishing a memoir on the subject, but his premature death prevented the accomplishment of his object. I am not aware of the male having ever been noticed by any author since that time; but perhaps the species described by me as *Pleuroxus hamatus* may prove to be the male of an allied species.

† *Monoculus striatus*, Jurine.

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* Jurine, Hist. des Monoc., pp. 155-6.

† Mag. Zool. and Bot., ii. 412.

This family contains seven British genera.

1. Eurycercus.—Subquadrangular; abdomen very broad, in form of a flat plate, densely serrated.
2. Chydorus.— Nearly spherical in shape; beak very long and sharp, curved almost into the shape of a crescent; inferior antennæ very short.
3. Camptocerus.—Ovoid-shaped; abdomen long, slender, and extremely flexible; serrated.
4. Acroperus.—Shell somewhat harp-shaped, terminating inferiorly on the anterior margin in a more or less blunt point projecting forwards; inferior antennæ rather long.
5. Alona.—Shell quadrangular, striated or grooved longitudinally; inferior antennæ short.
6. Pleuroxus.—Anterior margin prominent on the upper portion; the lower part being truncated, or, as it were, cut sharp and straight; first pair of feet very large.
7. Peracantha.—Oval-shaped; lower extremity of shell slightly curved backwards, and, as well as upper extremity of the anterior margin, beset with strong, hooked spines.

Genus 1—Eurycercus.‡

Lynceus, *Müller, et auctorum.*
Eurycercus, *Baird*, Ann. Mag. Nat. Hist. ii; Trans. Berw. Nat. Club, ii.

Character.—Subquadrangular. Abdomen very broad, in form of a flat plate, densely serrated. Beak blunt, slightly curved downwards.

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* Pritchard's Micros. Cab., p. 81.
† Vide supra, p. 9.
‡ From ευρυς, broad; and κερκος, a tail.

1. EURYCERCUS LAMELLATUS. Tab. XV, figs. 1, 1 *a-l*.

LYNCEUS LAMELLATUS, *Müller,* Zool. Dan. Prod., No. 3396, 1776;
Entomost., 73, t. 9, f. 4-6.
— *Latreille,* Hist. Nat. Crust., 208.
— *Baird,* Trans. Berw. Nat. Club, i, 100.
— *M. Edwards,* Hist. Nat. Crust., iii, 388.
— *Koch,* Deutsch. Crust., h. xxxvi, t. 9.
MONOCULUS LAMELLATUS, *Gmelin,* Linn. Syst. Nat., 3008, No. 62.
— *Manuel,* Encyc. méth., vii, 733, No. 62,
t. 268, f. 21-3.
— *Fabricius,* Ent. Syst., ii, 498.
EURYCERCUS LAMELLATUS, *Baird,* Ann. Mag. Nat. Hist., ii, 88, t. 2, f. 1-8.
1843; Trans. Berw. Nat. Club, ii, 150.

This is the largest of all the known species of this family, being in old specimens fully as large as the *Daphnia vetula.*

Shell of an olive colour; rather square-shaped, ciliated on anterior margin; ventricose in centre, and arched on posterior edge. Beak rather blunt and short.

Superior antennæ are stout, solid bodies, somewhat conical in shape, slightly curved, and terminating in six short spines, each of which gives out a fine seta or bristle. They are not possessed of much motion. Inferior antennæ or rami very short, compared with the size of the insect, and two-branched; both branches of about equal length. The anterior branch has five long filaments, one from the extremity of first and second joints, and three from the third; this joint has also a short spine. The posterior branch has three long filaments, all springing from the extremity of last joint, and the first and second have each only a short spine. These filaments are finely plumose, like those of the *Daphnia pulex,* and jointed about the middle of their length.

Eye large, contained in its funnel-shaped sheath of muscles, areolar; areolæ about twenty in number. The accompanying black spot is remarkably small, situated almost directly under the eye instead of in front, and is somewhat of a square shape.

Intestine convoluted (t. XVII, f. A), having one incomplete convolution and half another. Lower part of the body of the animal has a lobe springing out from its edge like a spur. Setæ at the joint of the abdomen finely plumose, and jointed at about half their length.

Abdomen very broad, lamellar, densely and strongly serrated on lower edge; sinuated deeply on anterior margin, and terminating in two stout claws and two small ones.

The mandibles are strong, rounded towards the extremity, which is armed with sharp teeth. The first pair of feet consists of a strong fleshy sort of body, ciliated on the upper edge, and terminating in five long and strong filaments, which generally project outside of the shell. The other feet consist of broad plates, with the branchial apparatus attached, and resemble a good deal those of the Daphnia.

The motion of this insect is peculiar; it generally lives at the bottom of the vessel in which it is kept, and when disturbed, it bounds up by rapid short motions in a curved sort of line, and then returns in the same manner to the place from where it rose. It is very heavy and slothful compared with the other genera, and I have frequently turned it over two or three times before it has moved.

Hab.—Not uncommon in ponds and ditches, during the summer months. Near Isleworth, and elsewhere in the neighbourhood of London. In Yetholm Loch; and pool on Bowmont Water, near Yetholm, Roxburghshire.

Genus 2—CHYDORUS.

LYNCEUS, *Müller, et auctorum.*
CHYDORUS, *Leach,* Supp. Encyc. Brit.
— *Baird,* Ann. Mag. Nat. Hist., ii; Trans. Berw. Nat. Club, ii.

Character.—Nearly spherical in shape. Beak very long and sharp, curved downwards almost into the shape of a crescent. Inferior antennæ very short.

1. Chydorus sphæricus. Tab. XVI, fig. 8.

Lynceus sphæricus, *Müller*, Zool. Dan. Prod., No. 2932, 1776; Entomost., 71, t. 9, f. 7-9.
— *Latreille*, Hist. gén. Crust., 207.
— *Lamarck*, An. s. Vert., v, 128, No. 3.
— *Desmarest*, Cons. gén. Crust., 377.
— *Baird*, Trans. Berw. Club, i, 100.
— *M. Edwards*, Hist. Crust., iii, 386.
— *Pritchard*, Micros. Cab., t. 8, f. 3.
— *Koch*, Deutsch. Crust., h. xxxvi, t. 13 (*not* h. viii, t. 2.)
Monoculus sphæricus, *Gmelin*, Linn. Syst. Nat. 3008, No. 60.
— *Manuel*, Encyc. méth., vii, 732, t. 268, f. 15-17.
— *Fabricius*, Ent. Syst., ii, 497.
— *Jurine*, Hist. Monoc., t. 16, f. 3.
Monoculus infusorius (Kleinster Schildfloh), *Schrank*, Enum. Insect. Aust., 536.
— *Eichhorn*, Beyt. Naturg., t. 3, f. *d.*[*]
Chydorus Mülleri, *Leach*, Enc. Brit. Supp., art. Annulosa, 1816; Dict. Sc. Nat., xiv., 541.
Chydorus sphæricus, *Baird*, Ann. and Mag. Nat. Hist., ii, 89, t. 2, f. 11-13, 1843; Trans. Berw. Nat. Club, ii, 150.

Shell round, smooth, slightly ciliated on anterior margin, of an olive green colour. Inferior antennæ or rami very short; anterior branch has four setæ, three springing from the extremity of the last articulation, and one from the extremity of the second; posterior branch has only three from the last joint. Intestine convoluted, having one complete convolution and half another.

Abdomen jointed, and having two stout claws at its end; the intestine passing through the joint, and terminating in the anus near the claws.

Eye areolar; its accompanying black spot pretty large, and situated just above the root of the superior antennæ.

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[*] Perhaps this may be a new species. Müller quotes this figure of Eichhorn for his *L. trigonellus*, but it appears to me to be quite distinct. It resembles the *sphæricus* in shape, except that the inferior extremity of the shell is pointed. Should it prove a new species, we would propose to name it *Chydorus Eichhorni*.

Its motion through the water is more like rolling, as Jurine describes it, than swimming.

The mandibles, feet, and superior antennæ are very similar to those of the preceding genus.

According to Pritchard, "the young play near their parent, and at the approach of danger swim for protection, within the shell of the mother, which she, conscious of their feebleness, immediately closes."*

Hab.—Ponds and ditches; common almost all the year round.

2. CHYDORUS GLOBOSUS. Tab. XVI, fig. 7.

CHYDORUS GLOBOSUS, *Baird*, Ann. and Mag. Nat. Hist., ii, 90, t. 3, f. 1-4, 1843; Trans. Berw. Nat. Club, ii, 150.

Shell quite globular, a good deal resembling in form the preceding species, but more completely rounded, and nearly six times larger; striated circularly on exterior and upper margin, and spotted with small black spots; the anterior portion of the shell is of a red hue, with a large, irregular-shaped, dark band running across the centre of the shell, and occupying about half its extent. The beak is extremely long, and at times appears to lie close to the body.

Abdomen (t. XVI, f. 7 *c*) elbowed at the joint, and hollowed out immediately before it, terminating in two long claws.

Eye large, areolar. Superior antennæ large, with seven teeth, and seven long setæ. Inferior antennæ or rami (t. XVI, f. 7 *b*) very short and slender; anterior branch with four setæ, one from the second, and three from the last articulation; posterior branch has only three from the last joint. First pair of feet large. Intestine convoluted (t. XVII, f. B), having one turn and a half.

The motion of this species is very much like that of a Cypris.

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* Micros. Cab., p. 90.

Hab.—Pond near Isleworth; ditch near Richmond; June, July, August, and September, but rare, and confined apparently to small patches. Pond near Bexley Heath, July. Ornamental water in Regent's Park, July; T. Rupert Jones, Esq.

Genus 3—CAMPTOCERCUS.*

LYNCEUS, *Müller, et auctorum.*
CAMPTOCERCUS, *Baird,* Ann. and Mag. Nat. Hist., ii; Trans. Berw. Nat. Club, ii.

Character.—Ovoid-shaped. Abdomen very long, slender, and extremely flexible; much serrated. Beak blunt, slightly curved downwards.

1. CAMPTOCERCUS MACROURUS. Tab. XVI, fig. 9.

LYNCEUS MACROURUS, *Müller,* Zool. Dan. Prod., 2397, 1776; Entomost., t. 10, f. 1-3.
— *Latreille,* Hist. Nat. Crust., 207.
— *M. Edwards,* Hist. Nat. Crust., iii, 388.
MONOCULUS MACROURUS, *Gmelin,* Syst. Nat., 3008, No. 65.
— *Manuel,* Enc. méth., vii, 733, No. 65, t. 268, f. 26, 27.
— *Fabricius,* Ent. Syst., ii, 499.
CAMPTOCERCUS MACROURUS, *Baird,* Ann. and Mag. Nat. Hist. ii, 91, t. 3, f. 5, 6, 1843; Trans. Ber. Nat. Cl., ii, 150.

Of an ovoid shape. Shell pellucid and whitish, finely striated or ribbed longitudinally, slightly sinuated and ciliated on anterior margin. Beak rounded, and rather blunt. Eye small, but areolar, accompanying black spot nearly as large as the eye.

Superior antennæ rather long and slender, terminating setæ long also. Inferior antennæ or rami short. Anterior branch with four long filaments and one short; one long, from second articulation; three long and one short, from last; posterior branch has only three long filaments and one short, from the last joint.

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* Καμπτος, flexible; and κερκος, a tail.

Abdomen (t. XVI, f. 9 *a*) very long and slender, with thirteen well-marked serræ, or teeth, on lower edge, and several smaller ones, terminating in two long and slender claws; setæ short. This organ, and lower part of body, is extremely flexible, and the animal can twist it completely round in a circle, and then unbending it, thrust it far out beyond the shell.

First pair of feet large.

Intestine convoluted, having one complete convolution, and half another.

Hab.—Ditch near Richmond. Pond near Smallborough Green, Hounslow. Highgate ponds. June, July, and August.

Genus 4—ACROPERUS.*

LYNCEUS, *Baird*, Trans. Berw. Nat. Club, i.
ACROPERUS, *Baird*, Ann. and Mag. Nat. Hist., ii; Trans. Berw. Nat. Club, ii.

Character.—Shell somewhat harp-shaped, terminating inferiorly on anterior margin, in a more or less blunt point, projecting forwards. Inferior antennæ, or rami, long. Beak blunt, curved downwards.

1. ACROPERUS HARPÆ. Tab. XVI, fig. 5.

LYNCEUS HARPÆ, *Baird*, Trans. Berw. Nat. Club, i, 100, t. 2, f. 17, 1835.
ACROPERUS HARPÆ, *Baird*, Ann. and Mag. Nat. Hist., ii, 91, t. 3, f. 7, 1843; Trans. Berw. Nat. Club, ii, 151.
LYNCEUS LEUCOCEPHALUS, *Koch*, Deutsch. Crust., h. xxxvi, t. 10, 1841.

Shell rounded posteriorly, sinuated rather deeply, and ciliated anteriorly; terminating in an obtuse point, projecting forwards; strongly striated, or rather ribbed, longitudinally and somewhat obliquely, giving the shell, which is quite transparent, a good deal of resemblance to a harp. Beak rounded and obtuse.

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* From ακρος, pointed; and περας, extremity.

Eye areolar; accompanying black spot nearly half the size of the eye, and rather square-shaped.

Superior antennæ of considerable length, the terminating setæ being much longer than in the other genera. Inferior antennæ or rami slender, and of considerable length, each branch provided with three long setæ from the extremity of last articulation only.

The rami and setæ together extend almost the length of the shell, reaching nearly to its inferior extremity.

The upper part of the body of the animal is very rounded, and crenated on the outer edge.

Abdomen slender, not serrated on under margin, but marked near the edge with a row of indentations, and terminating in two claws, which are long and slender.

First pair of feet large.

Intestine convoluted, having one turn, and nearly half another.

Hab.—Pond in Osterly Park; ditch near Richmond; pond on Bowmont Water, Yetholm, Roxburghshire; Dunglass Pond, East Lothian. Summer months.

2. ACROPERUS NANUS. Tab. XVI, fig. 6.

ACROPERUS NANUS, *Baird*, Ann. and Mag. Nat. Hist., ii, 92, t. 3, f. 8, 1843; Trans. Berw. Nat. Club, ii, 151.

Somewhat resembles the last in shape, but is very small, not the seventh part the size; is less transparent, less deeply sinuated on anterior margin, and less projecting at lower extremity.

The striæ or ribs are not so large, and are disposed in a waved form, obliquely transverse; anterior margin ciliated.

Beak rather long, sharper than in the preceding species.

Inferior antennæ or rami slender, and rather shorter than in *harpæ;* anterior branch has four setæ, one springing from the second, and three from the extremity of last joint only.

Abdomen has a gibbous projection about the middle of the lower margin, and is serrated at extremity. Intestine convoluted, having one turn, and nearly half another. One ovum.

In size, this species is about the smallest of the family that I have met with.

Hab.—Pond at Norwood Green; and near Southall, Middlesex, June 1841. Rare.

Genus 5—ALONA.

LYNCEUS, *Müller, et auctorum.*
ALONA, *Baird,* Ann. and Mag. Nat. Hist., ii; Trans. Berw. Nat. Club, ii.

Character.—Shell quadrangular-shaped, grooved or striated longitudinally. Inferior antennæ or rami short. Beak blunt, and nearly erect.

1. ALONA QUADRANGULARIS. Tab. XVI, fig. 4.

LYNCEUS QUADRANGULARIS, *Müller,* Zool. Dan. Prod., No. 2393, 1776; Entomost., t. 9, f. 1-3.
— *Latreille,* Hist. Crust., 208.
— *Baird,* Trans. Berw. Nat. Club, 100.
— *M. Edwards,* Hist. Crust., iii, 388.
— *Koch,* Deutsch. Crust., h. xxxvi, t. 15.
MONOCULUS QUADRANGULUS, *Gmelin,* Syst. Nat., 3008, No. 61.
— *Manuel,* Enc. méth., viii, 733, t. 268, f. 18-20.
MONOCULUS QUADRANGULARIS, *Fabricius,* Ent. Syst., ii, 498.
MONOCULUS STRIATUS (?), *Jurine,* Hist. Monoc., t. 16, f. 1, 2.
ALONA QUADRANGULARIS, *Baird,* Ann. and Mag. Nat. Hist., ii, 92, t. 3, f. 9-11, 1843; Trans. Berw. Nat. Club, ii, 151.

Nearly quadrangular-shaped. Shell transparent, of a deep-brown colour; strongly ciliated on anterior margin, cilia long; striated or ribbed longitudinally, the ribs rather distant. Beak rather blunt. Eye areolar.

Superior antennæ conical-shaped; inferior, or rami (t. XVI, f. 4 *b*), short, the setæ also being short; anterior branch having four, one from second and three from last articulation; posterior branch has three from last joint only.

Upper part of body rounded, as in *Acroperus harpæ.*

Abdomen (t. XVI, f. 4 *c*) rather narrow, sinuated near extremity, and serrated for about half its length on the under edge, the serræ or teeth at extremity being the largest. Terminating claws long.

Intestine convoluted once, and nearly a half, but not so distinctly visible as in the other genera.*

Hab.—Ditch near Richmond; pond at Osterly Park; and near Hounslow. In the Pease-burn, Cockburnspath. Pool on Bowmont Water, Yetholm, Roxburghshire.

2. Alona reticulata. Tab. XVI, fig. 3.

Alona reticulata, *Baird,* Ann. and Mag. Nat. Hist., ii, 93, t. 3, f. 12, 1843; Trans. Berw. Nat. Club, ii, 151.

In size this is perhaps the smallest of all the species of this family, being still smaller than the *Acroperus nanus.*

Shell of a quadrangular shape, rounded a little posteriorly, and nearly straight on anterior margin, which appears free from cilia. The lower margin is obtuse, and the whole shell is very closely reticulated.

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* I had some doubts at first as to this being identical with the *Monoculus striatus* of Jurine. In his figure the beak is blunter, and the abdomen shorter and rounder-shaped than in my specimens. He gives it the name *striatus* with a doubt; and remarks, "if this species be the *truncatus* of Müller, as we may presume it is, it must be confessed that its specific name is improper; for the shell is not truncated, it is obliquely striated and strongly ciliated" (l. c., p. 154). It is evident that Jurine could never have seen the *truncatus* of Müller, and the *quadrangularis* seems also not to have been known to him; for the difference between this species and the *truncatus* is so great and evident, that they cannot be mistaken for each other; while the similarity between it and the *quadrangularis* is so decided, that notwithstanding the slight discrepancies mentioned above, I have now little or no hesitation in referring them both to the same species.

Beak prominent and long, projecting upwards, rather blunt. Eye large for size of animal, areolar.

Inferior antennæ or rami rather slender; anterior branch provided with four setæ, one short from second, and three long and stout, from last articulation; posterior branch has three from last joint only.

Abdomen rather tapering towards the extremity, and serrated on inferior margin.

Intestine convoluted, but it is not easily seen from reticulated surface of shell. One ovum.

Hab.—Pond near Southall, Middlesex, July 1841; September 1849.

3. Alona ovata. Tab. XVI, fig. 2.

Ovately globose; transparent; shell striated; striæ waved longitudinally.

Superior antennæ short. Beak of carapace or shell rather short and blunt.

Anterior edge of shell densely ciliated. Eye areolar, anterior black spot large.

The head is erect, as in *A. quadrangularis.*

Intestine convoluted.

Tail hollowed out a little, about the centre of its inferior edge, then bulges out, and is armed with short spines, and finally terminates in two short, curved claws.

In size it is rather larger than the *A. quadrangularis.*

Hab.—Pond on Blackheath, April 1848.

Genus 6—PLEUROXUS.*

LYNCEUS, *Müller, et auctorum.*
PLEUROXUS, *Baird*, Ann. and Mag. Nat. Hist., ii; Trans. Berw. Nat. Club, ii.

Character.—Anterior margin prominent on upper portion, the lower part being truncated, or, as it were, cut sharp and straight. First pair of feet very large. Beak sharp, curved downwards.

1. PLEUROXUS TRIGONELLUS. Tab. XVII, fig. 3.

LYNCEUS TRIGONELLUS, *Müller*, Zool. Dan. Prod., No. 2395, 1776; Entomost., t. 10, f. 5, 6.
— *Latreille*, Hist. gén. Crust., 205.
— *Lamarck*, An. sans Vert., 123, No. 2.
— *Baird*, Trans. Berw. Nat. Club, 100.
— *M. Edwards*, Hist. Nat. Crust., iii, 387.
— *Koch*, Deutsch. Crust., h. xxxvi, t. 14.
MONOCULUS TRIGONELLUS, *Gmelin*, Linn. Syst. Nat., 3003, No. 63.
— *Manuel*, Encyc. méth., vii, 733, No. 63, t. 268, f. 24, 25.
— *Fabricius*, Ent. Syst., p. 498.
PLEUROXUS TRIGONELLUS, *Baird*, Ann. and Mag. Nat. Hist., ii, 93, t. 3, f. 13, 1843; Trans. Berw. Nat. Club, ii, 151.

Shell somewhat triangular-shaped, and transparent; gibbous on upper portion of anterior edge for about a third of its length, the lower two thirds being truncated, or, as it were, cut obliquely with a straight, sharp edge, and ciliated. Posterior margin gibbous also, and sinuated near lower extremity, which terminates in a square point.

Beak long and curved, sharp-pointed. Eye areolar.

Inferior antennæ or rami short and slender. The anterior branch has four setæ, one from first articulation, one from second, and two from last. Posterior branch has three setæ, all springing from last joint.

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* From πλευρον, a side; and οξυς, sharp.

Abdomen (t. XVII, f. 3 *c*) gibbous for latter half, and serrated.

First pair of feet (f. 3 *b*) very large ; the pediform organ of Müller being the first pair of feet.

Intestine convoluted, having one turn and nearly half another.

Hab.—Pond near Copenhagen Fields, Osterly Park, Norwood Green, and Southall, Middlesex, June to October. Pond at Fouldean, Berwickshire; and at Yetholm, Roxburghshire.

2. Pleuroxus uncinatus. Tab. XVII, fig. 4.

Shell slightly triangular in shape, transparent, and fluted; gibbous on upper portion of anterior edge, and less straightly cut on lower portion of anterior edge than in preceding species. At the inferior angle of this margin there are three sharp spines, and the margin itself is ciliated. The posterior margin is rounded and sinuated at the lower part, but not so deeply as in *trigonellus*, and the square point at extremity is shorter than in it.

The beak is long and curved; but the tip, instead of being curved downwards as in preceding species, is turned up.

The antennules, antennæ, feet, and abdomen, with intestine, are similar to those parts in *trigonellus*, and the animal is nearly of the same size.

The ova, in all the specimens I have met with, are only two.

The young exhibit the remarkable turned-up beak and the spines on inferior extremity of shell as soon as born.

Hab.—Pond between Hanwell and Southall, Middlesex, September 1849.

3. Pleuroxus hamatus. Tab. XVII, fig. 5.

Lynceus hamatus, *Baird*, Trans. Berw. Nat. Club, 100, t. 2, f. 18, 1835.
Pleuroxus hamatus, *Baird*, Ann. and Mag. Nat. Hist., ii, 94, t. 3, f. 14, 1843; Trans. Berw. Nat. Club, ii, 151.

About half the size of the preceding species.

Shell truncated anteriorly, and ciliated; extremely transparent; upper part gibbous.

Beak blunter and stronger than in *trigonellus*.

Inferior antennæ or rami with three setæ in each branch.

Abdomen gibbous, not serrated, terminated by two claws or hooks.

First pair of feet large, each furnished at extremity with a strong claw or hook turning upwards.

Intestine convoluted.*

Hab.—Yetholm Loch, and pool on Bowmont Water, near Yetholm Bridge, Roxburghshire, July 1835.

Genus 7—Peracantha.†

Lynceus, *Müller, et auctorum.*
Peracantha, *Baird*, Ann. and Mag. Nat. Hist., ii.

Character.—Oval-shaped; the lower extremity of shell slightly curved backwards, and, as well as the upper extremity of anterior margin, beset with strong, hooked spines. Beak sharp, curved downwards.

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* I have only once met with this species. It may perhaps be the male of *trigonellus*, the cheliform nature of the first pair of feet having a considerable resemblance to the structure of that organ in the male Daphnia, and more especially in the male of the Estheria, as represented by Joly in his description of the *Isaura cycladoides*, 'Ann. Sc. Nat.,' 2d series, xviii, 1843.

† From περας, extremity; and ακανθα, spine.

1. PERACANTHA TRUNCATA. Tab. XVI, fig. 1.

LYNCEUS TRUNCATUS, *Müller*, Entomost., 75, t. 11, f. 4-6, 1781.
— *Latreille*, Hist. Crust., 206.
— *Baird*, Trans. Berw. Nat. Club, 100.
— *M. Edwards*, Hist. Crust., iii, 388.
— *Koch*, Deutsch. Crust., h. xxxvi, t. 11.
MONOCULUS TRUNCATUS, *Gmelin*, Linn. Syst. Nat., 3008, No. 64.
— *Manuel*, Enc. méth., vii, 733, t. 268, f. 30-34.
— *Fabricius*, Ent. Syst., 498.
PERACANTHA TRUNCATA, *Baird*, Ann. and Mag. Nat. Hist., ii, 94, t. 3, f. 15, 1843; Trans. Berw. Nat. Club, ii, 151.

Shell nearly of an oval form, the lower extremity having a curved projection backwards, and provided with a number of pretty strong spines, about seventeen in number, the last three of which are curved backwards. On the upper extremity of anterior margin there are about an equal number of spines, the upper ones being curved upwards. These are partly concealed by the cilia, which densely cover the anterior margin of the shell. The shell is striated longitudinally.

Beak rounded and sharp-pointed, rather long.

Eye areolar; accompanying black spot of a square shape.

Superior antennæ conical-shaped; inferior, or rami (f. 1*a*), short. Anterior branch furnished with five setæ; one from first, one from second, and three from last articulation. Posterior branch has three setæ, all from last joint.

Abdomen rather gibbous on lower edge, and on latter half has about eight spines, and terminates in two stout claws. First pair of feet large.

Intestine convoluted (f. 1*b*), having one round and a half. Two ova.

Hab.—Pond at Osterly Park, ditch near Richmond, pond at Southall, Middlesex; summer months. Pool on Bowmont Water, Yetholm, Roxburghshire.

Legion II—LOPHYROPODA.[*]

Lophyropa, *Latreille,* Cuv. Règne An., iv, 150.
— *Say,* Journ. Acad. Nat. Sc. Philad. i.
Lophyropa *and* Ostrapoda, *Desmarest,* Cons. gén. Crust.
Lophyropoda, *Leach,* Dict. Sc. Nat., xiv, 524.
— *J. E. Gray,* Synops. Brit. Mus., 1842.
— *Burmeister,* Beitr. zur Naturg. der Rankenfussen.
Branchiopodes frangés (*pars*), *Lamarck,* Hist. An. s. Vert., v.

Character.—Mouth furnished with organs fitted for mastication. Branchiæ few, attached to the organs of mouth. Body having an envelope, either in form of a buckler, inclosing head and thorax, or in shape of a bivalve shell, inclosing the whole animal. Feet few in number, not exceeding five pairs. Articulations more or less cylindrical, and serving the animal for the purpose of locomotion. One eye. Two pairs of antennæ; one pair of which are used by the animal as organs of motion.

Order I—OSTRACODA.[†]

Ostracoda, *Latreille,* Hist. Nat. Crust., 1801; Cuv. Règne Anim., iv, 151.
— *Baird,* Mag. Zool. and Bot., i; Trans. Berw. Nat. Club, ii.
Ostracins *ou* Bitestacés, *Dumeril,* Zoologie Analytique, 1806.
Ostrapoda, *Straus,* Mém. Mus. d'Hist. Nat., vii.
Cyproides *ou* Ostracodes, *M. Edwards,* Hist. Nat. Crust., iii, 393.
Crophyropoda b., *Burmeister,* Organization of Trilobites (Ray Soc. edit.), 34.
Cypridacea *vel* Ostracoda, *Dana,* Proc. Amer. Acad. Sc., 1849.

Character.—Body inclosed entirely in a covering of two valves, resembling a bivalve shell. Posterior jaws branchiferous. No external ovary. Feet two and three pairs, adapted for progressive motion.

This order contains three families, Cypridæ, Cytheridæ, and Cypridinadæ.

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[*] From *λοφυρος*, having stiff hairs; and *πους*, foot.

[†] From *οστρακον*, a shell.

Family I—CYPRIDÆ.

Cypris, *Müller, et auctorum.*
Cyproides (*pars*), *M. Edwards,* Hist. Nat. Crust., iii, 393.
Cypridæ (*pars*), *Baird,* Trans. Berw. Nat. Club, ii, 153.

Character.—Two pairs of antennæ; superior long, with numerous joints, and a pencil of long filaments; inferior stout and pediform. Eye single. Feet two pairs.

Bibliographical History.—Baker is said to be the first author who has taken any notice of any of the animals of this family. In his work, 'Employment for the Microscope,' 1753, an anonymous correspondent describes at some length an insect which has a bivalve shell, somewhat resembling a small fresh-water mussel, and gives a figure of it lying on its back, which is barely sufficient to enable us to discern that it is a Cypris.

Straus complains that he cannot discover any mention made of the genus by Baker, either in the edition of 1743 or 1744, which are the only editions he has been able to see; neither is there, he says, any plate 15 in either of these editions. He quotes the wrong work, however, having referred to the 'Microscope made Easy,' instead of Baker's second work, 'Employment for the Microscope', in which he would have found the insect referred to by Müller.

Linnæus, in his 'Fauna Suecica,' 1746, describes a species in a few general terms; and, in the seventh edition of the 'Systemæ Natura,' 1748, he mentions a species under the name of *Monoculus concha pedata,* but gives no description. In the tenth edition of the same work, 1760, he gives the description, as taken from the 'Fauna Succica,' but names it *Monoculus conchaceus.*

Joblot, in his 'Observations d'Histoire Naturelle faites avec le Microscope,' 1754, describes a species, which he calls *poisson nommé Detouche,* or *Grain de Millet,* from its resemblance in size and colour to that species of seed, and gives a figure of it.

Ledermüller, in his work, 'Microscopischen Gemüths- und Augen-ergotzung,' 1760, gives several figures of a species of Cypris, and says, he has frequently seen them in copulation.

Poda, in his 'Insecta Musæi Græcensis,' 1761, gives one species, the *Monoc. conchaceus* of Linnæus, quoting merely his description.

Geoffroy, in his 'Histoire des Insectes,' 1762, after a few general remarks upon the Monoculi, describes shortly two species of the genus, but gives no figures of them.

Müller, in his 'Fauna Insectorum Fridrichsdalina,' 1764, only mentions one species under the name and description given by Linnæus, in his 'Faun. Suec.;' but in 1771 he published an admirable paper in the 'Philosophical Transactions' (attributed by M. Straus to Mr. Bennet, but only communicated by him), in which he gives an excellent account of two species in particular, with many details of their anatomy and habits, and concludes by giving a list of nine species, which he had at that time discovered, including them all, however, under the name of Monoculus. In his 'Zoologiæ Danicæ Prodromus,' 1776, he first established the genus Cypris, as well as the other genera of Entomostraca, all of which had until then been constantly described under the general name of Monoculus.

Fabricius, in his 'Systema Entomologiæ,' 1775, gives Linnæus's species, the *Monoculus conchaceus;* and De Geer, in his 'Mémoires pour servir à l'Histoire des Insectes,' 1778, describes one or two species, though he calls them only varieties of the same, and adds a few details concerning them.

In 1785 appeared the 'Entomostraca' of Müller, with copious details and descriptions, and pretty accurate figures of all the species already shortly noticed in his 'Zool. Dan. Prod.,' and at the end of his paper in the 'Philosophical Transactions,' which paper is also reprinted in French, at the commencement of this excellent work. Up to the time that Müller undertook the working out the species of this genus, our knowledge of them was, indeed, scanty. The descriptions found in the authors I have already quoted previous to him were so superficial, that even when illustrated by figures, which were also generally very bad, there was no possibility of distinguishing what species they meant to describe. This difficulty may be readily seen, upon inspecting the synonyms given by Müller, and then referring to the authors quoted by him, where we can easily observe that he himself has made several mistakes in such references—neither the description nor figures of such agreeing with his. For instance, under the species *pubera,* he refers to the *Monoculus conchaceus* of Linnæus, with the description which that author gives in his 'Fauna Suecica,' "Antennis capillaceis multiplicibus, testa bivalvi;" a description so very general, that it answers equally well to any or all of his eleven species. He also refers to Joblot for the same species; but from the representation which that author gives, as well as from his description, it appears to me that it bears a much closer resemblance to Müller's *candida;* and the reference to De Geer is equally faulty, as it is evident that fig. 5, and figs. 6, 7, both of which are quoted by Müller as the *pubera,* are in reality two distinct species! In determining the species, therefore, we must consider the researches of the various authors previous to Müller as of little or no use whatever. Indeed, after Müller's time, all the authors who have taken notice of this family have done little else but copy him till the appearance of Straus's paper, and the work of Jurine. For instance, Gmelin, in the 13th edition of the 'Syst. Nat.,' 1788, not only quotes Müller's species, but gives his erroneous references also, adding one or two of his own. He gives, however, two additional species, which Müller has not; and Manuel, in his article Monocle, in the 'Ency. méth. Hist. Nat.,' vii, 1792, after a few general details, copies the same species that Gmelin gives; while Fabricius, in his 'Ent. Syst.,' 1793, gives the eleven species, which Müller describes, retaining, in addition to this, Gmelin's erroneous synonyms.

Bosc, in his 'Hist. Nat. des Crust,' édit. Buffon, par Deterville, 1802, gives a very interesting account of this genus, as does also Latreille, in his 'Hist. Nat. des Crust. et Ins.,' édit. Buffon, par Sonnini, 1802; but they only mention Müller's species.

Ramdohr in 1805 published his little work on the Monoculi,* in which he gives some very excellent details concerning the anatomy of the Cypris, accompanied by some very good figures; but his work does not seem to be known to almost any of the succeeding naturalists who have written upon the Cypris. He only describes in this work the *Cypris strigata* of Müller; but in 1808, in a paper in the 'Magaz. Gesell. Nat. Berlin,' he describes at considerable length three additional species which had not been noticed before.

M. Daudebart de Férussac fils, in a memoir in the 'Ann. du Mus. d'Hist. Nat.,' vii, 1806, describes one new species, and Risso, in his 'Hist. Nat. des Crust. des Env. de Nice,' 1816, two others; but though these additions were made to the number of known species, and although Latreille, in Cuvier's 'Règne Animal,' 1817, and Lamarck, in his 'Hist. Nat. des Anim. sans Vert.,' 1818, give a variety of details relating to the genus generally, little real knowledge concerning the anatomy of the inhabitants of the tiny shells was conveyed to us (for Ramdohr's work and paper seem to have attracted scarcely any notice), till M. Straus published his admirable paper on the genus Cypris, in the seventh volume of the 'Mém. du Mus. d'Hist. Nat.,' 1821; containing a most elaborate anatomical description of the genus, with a notice, and figures of three new species, not described by Müller.

About the same period as Straus read his paper before the Academy, appeared Jurine's splendid work on the Monoculi, replete with interesting details of the genus generally, and with beautiful figures of eighteen species. But we find no reference made by either of these authors to the previous labours of Ramdohr.

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* Beyt. zur Naturg. Deuts. Monoc. Arten, 1805.

Desmarest, in his 'Consid. gén. sur les Crust.,' 1825, although he gives a very good account of the different genera, taken chiefly from Straus and Jurine, with an account of twenty-one species, takes no notice of him either; but Latreille, in the last edition of the 'Règne Animal,' 1829, notices his memoir, with all due approbation, and has thus contributed much to disseminate the knowledge of his researches. Up to that period we know of no original memoir upon this genus having been published in this country; Leach's article on the Crustacea, in the 'Edinburgh Encyclopædia,' containing no details whatever, and only taking notice of one or two species.

In 1835 I published a description of nine new species in the 'Trans. Berw. Nat. Club;' and in 1837, in the 'Magazine of Zoology and Botany,' I gave two additional, all natives of this country. In the 'Transactions of the Entomological Society,' vol. i, Mr. Templeton has described two new species in the Mauritius; and Koch, in the 'Deutschlands Crustaceen,' 1837, 1838, has described and figured no less than twenty-one new species, though I am of opinion that several of them had been previously described, and others are mere varieties. In 1841, Mr. Haldeman, in the 'Proceedings of the Acad. of Nat. Sc. at Philadelphia' has shortly described and figured in outline two others, found in America. M. Lucas describes another found by him in Algeria.

Anatomy and Physiology.—Ramdohr, Jurine, and Straus all differ in many respects in describing the anatomy of the genus Cypris, both as regards the nomenclature and the use of the parts. The last author who has described them anatomically is M. Edwards; and as his definition of the organs of locomotion, &c. are more consonant with our knowledge of other Entomostraca, we shall follow him, taking the details, however, chiefly from Straus, whose memoir stands pre-eminent amongst those of his fellow-labourers.

The body of the animal is completely inclosed within a shell of two valves, of a horny-cretaceous substance, which in general appearance closely resembles that of a very small mussel, so much so that, as Müller remarks, a person at first sight of this insect would suppose that it was a parasite inhabiting the shell of some small mollusc. The substance of these valves is compact and very brittle, and seems to be endued externally with a species of varnish to protect them from the action of the water, as whenever they rise to the surface the shell becomes perfectly dry, and floats there in spite of the animal's struggles to again immerse itself. The valves are open in their whole circumference, except in the middle third of the dorsal surface, where they are united by a ligamentous hinge and muscles, by which the animal can open and shut the shell at pleasure. About the middle of each valve in most species are to be seen a number of small lucid spots, the use of which I do not know. Müller has taken notice of them in the *pubera*, and asks "an ovula?" but there is no connexion between them and the ova. No other author has mentioned them; they are to be met with perhaps in all the species.

The body of the insect (t. XVIII, f. 1*a*) consists of two rounded portions of unequal size, connected together by a narrow space, and having on their upper surface a transparent body, which is the matrix. From the anterior or thoracic portion spring the two superior antennæ, immediately above which is situate the eye, the inferior antennæ, the organs of the mouth, and the first pair of feet. From the posterior or abdominal portion spring the second pair of feet and the tail.

The eye is single, fixed, and in the form of a black sessile tubercle, in which we can discover no traces of crystallines.

The superior antennæ are inserted immediately below the eye, and have their origin near each other (t. XVII, f. 1*b*). In general they consist of seven articulations,* from the three or four terminating ones of which arise several pretty long filaments, which vary in number in the different species. Whenever the animal moves, it invariably puts these organs into rapid motion, dilating and bringing together again the long filaments, and waving them to and fro with great rapidity. They are thus considered by Müller and Straus to act as true fins, and to be the principal organs of progressive motion. Jurine, however, says that, from their position in the anterior part of the body, and from their motions being thus confined by the opening of the shell, they cannot be considered as acting the part of true fins, and that their use in progressive motion is by no means equal to that of the inferior antennæ, called by him the anterior feet. In the larger species we see these filaments to be beautifully plumose, a circumstance which has never been pointed out by any of the various authors who have written upon the genus, and which strengthens Latreille's suggestion that they may act as respiratory organs, as well as the branchial plates of the jaws. The inferior, or second pair of antennæ (t. XVIII, f. 1 *c*), arise immediately beneath the others; they are very strong, and resemble in appearance feet as much as antennæ: indeed, they have almost invariably been considered and described as the first pair of feet. Their position, however, in front of the mouth and organs of mastication, as in the other genera of Entomostraca, and their resemblance to the inferior antennæ of the Cyclopidæ, warrant us, along with M. Edwards, in considering them as antennæ. They consist each of five articulations:* two belonging to the basilar portion, short, and directed downwards; a third, longer, directed forwards; and two terminating joints, the first of which, in most of the species, gives off at its lower extremity a bundle of setæ, which are frequently plumose; and the last being terminated by several tolerably strong hooked spines or claws. This pair of antennæ, therefore, by this organization is fitted for both swimming and walking; the filaments assisting in the former, and the hooked claws at the extremity aiding in this latter purpose, enabling them to seize hold of the plants, &c. among which they live, and thus walk from place to place. Latreille considers these long filaments as acting, along with those of the superior antennæ, the part of respiratory organs.

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* Jurine says eight.

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* Jurine says eight.

The mouth is situate in the inferior surface of the anterior lobe of the body, and consists of a lip, an inferior lip, a pair of palpiferous mandibles, and two pairs of jaws. The lip is composed of a large piece, shaped somewhat like a hood, forming a projection which advances between the two inferior antennæ, and is fixed to the body by four long apophyses. The inferior lip is elongated, triangular, and moveable; is articulated with the lip, and has at its extremity two curved apophyses to articulate it with the second pair of jaws.

The mandible (t. XVIII, f. 1 *d*) is very large, and is formed of two pieces. The larger, or mandible properly so called, is terminated at its superior extremity by a point, and at the lower or incisive extremity by five pretty strong teeth. The other piece is in form of a palpus, which issues from about the middle length of the proper mandible, and consists of three joints provided with several setæ. The first joint has near its base a very small branchial plate terminated by five digitations. This palpiform part of the mandible is the second pair of feet of Jurine, the barbillon of Müller; the use of which, both agree, is to cause a current of water towards the mouth, carrying with it the particles destined for the animal's food. The first pair of jaws (t. XVIII, f. 1 *e*) have for their base a large square plate, furnished at anterior extremity with four fingers, the superior of which is of two joints, the other three having only one each, but all terminated by several long hairs. From the external edge of this plate, forming the base, arises a large, elongated, branchial plate (f. 1 *e* *), which gives off from the superior crescentic-shaped edge a row of nineteen long spines, arranged like the teeth of a comb. The square plate with its fingers must be Jurine's third pair of feet; though, if so, the figure which this author gives of these organs, as well as of his second pair of feet (the palpi of the mandible of Straus), is decidedly incorrect.* The second pair of jaws is much smaller, and is articulated on to the posterior angle of sternum, by means of the two curved apophyses at its extremity (t. XVIII, f. 1 *f*). Each jaw consists of two flattened joints, the latter of which has several stiff hairs at its extremity, and from its external edge gives off a rounded finger, which Straus says he thinks must be considered as a palpus.

There is much discrepancy amongst the several authors I have so frequently mentioned as to the number of feet. Müller and Ramdohr assert there are four, and the former remarks upon the singularity of an *insect quadruped.* Straus enumerates six; while Jurine says there are eight.† M. Edwards however restricts, very properly, the number to two pairs. The first pair (t. XVIII, f. 1 *g*) is slender, cylindrical, and composed of five articulations; the last of which is terminated by one long curved hook. The basilar joints of these organs are directed backwards; the succeeding joints downwards, and the terminating ones forward. The second pair (t. XVIII, f. 1 *h*) arises immediately behind the first, and consists of four articulations,‡ the last of which is terminated by two short hooks, and has a filament thrown back from its extremity like a spur.

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* He seems to have been ignorant of the existence of the branchial plate, as he asks, "If it be true that the branchiæ be the first character of the Crustacea, where shall we place them in these Monoculi? In the antennæ, feet, or tail? We cannot give a preference to any one of these parts over another."

† Müller was not aware of the existence of the organs which Straus calls the third pair of feet. Ramdohr was, but considers them as connected with the male organs of generation; while Jurine says that they are organs arising from the matrix, the use of which he does not understand. In addition to the first and second pairs of Müller, Ramdohr, and Straus, Jurine considers the organs which Müller calls the "barbillons," attached to the mouth (the palpi of the mandibles of Straus) and the branchial plate of the upper jaw, as two additional pairs of feet.

‡ Straus says five.

They are curved upwards and backwards, and are always contained within the shell, never being extended. Their use, according to Straus, is to support the ovaries.* The posterior portion of the body or abdomen (t. XVIII, f. 1 *i*) is conical-shaped, terminating in two lengthened stalks, each of which gives off at the extremity two short hooks, with a third implanted on the upper edge, a little above them. This abdominal portion of the body is unattached, and possesses much freedom of motion, the animal extruding it from the shell at pleasure. One great use of it seems to be to clean the interior part of the shell, which its length and mobility fit it well for; but Straus asserts that the object of this organ is for depositing the eggs. The anatomy of the internal parts of the body is more difficult to make out distinctly.

The alimentary canal, according to Straus, consists of a short, narrow œsophagus, a large oblong stomach, occupying the whole of the dorsal region of the body, and a simple intestine nearly as large as the stomach, becoming narrower towards the posterior extremity, and opening by an anus between the two stylets which form the tail. The ovaries are two large, simple, conical vessels, placed externally upon the posterior portion of the body, and open one at the side of the other into the anterior part of the extremity of the abdomen, where they communicate with the canal formed by the tail or abdomen. There is another organ, the use of which is not so well ascertained. It is a large and conical mass, situate above the articulation of the mandibles, of a granulated structure apparently, and of a light colour. Straus says, that as he could not see exactly its termination, he is ignorant of its use, but supposes that it must be either the salivary glands, or the testicle.

The heart and nervous system have as yet escaped observation. The animals of this family are all inhabitants of fresh water, and are to be found in every pond and ditch where the water remains stagnant, but not putrid.

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* Jurine considers them as somewhat connected with the matrix, but says he is ignorant of their use. The figure which he gives of them is very incorrect.

They are not so prolific as the Cyclopidæ, but in some of the larger species we can count sometimes, according to Jurine, as many as twenty-four eggs. The males have never yet been discovered, and the act of copulation has never been witnessed by any author, with the exception of Ledermüller, who says he has seen them in the act, and gives a representation of them in that state. I have frequently witnessed two individuals in much the same situation as those figured by Ledermüller, but it did not appear to me that they were at the time engaged in copulation; and as neither Müller, De Geer, Jurine, nor Straus have ever witnessed them in the act, Ledermüller must in all probability have mistaken the nature of their junction. Straus states that every specimen he has examined has been laden with eggs, which makes him ask, "Are they hermaphrodites? or do the males only appear at some particular season of the year?"

Jurine has collected eggs immediately after they had been deposited by the parent animal, has isolated them, and seen them safely hatched. He has then isolated the young after they were hatched, and found that they became pregnant without the intervention of the male. They must either, therefore, be hermaphrodites, or, as in the Daphniadæ, one copulation suffices not only to impregnate the female for life, but the succeeding generations also; as the males of the Daphniadæ, too, appear only at particular seasons of the year, and in small numbers, it is probable that the males of the Cypridæ will be found hereafter by succeeding observers. The eggs are perfectly spherical, and are deposited by the animal upon some solid body, such as part of a plant, &c., in a mass, which at times, says Straus, consists of some hundreds from various individuals, the mother fixing them to the surface of the body on which they are deposited, by means of a glutinous kind of substance, and then leaving them. When the animal is about to lay, it fixes itself, says Jurine, so firmly in a place of security, that it cannot be displaced by any agitation of the water, and is occupied twelve hours in the operation. The eggs remain about four days and a half before they are hatched, and then the young at once assume the appearance of the perfect animal, though varying a little in shape of shell. According to Jurine they undergo several moultings before they are fit to procreate their species; the frequency of these moultings depending upon the season of the year, and being in proportion to the gradual development of the animal. Moulting continues to take place in the adult after each laying, and as the shells of these little animals get very frequently covered with dirt and moss, which adhere close to them, this change of covering becomes a useful act to disembarrass the animal of a shell now disagreeable to it; while in the young, their development can only take place by getting rid of the shell as soon as it becomes too small for the body contained within. The renewing of the shell forms a fine example of the process of exuviation, as naturalists term it. The change which takes place being most complete; for not only does the shell itself fall off, but the animal even casts off the internal parts of the body, the fine pectiniform branchiæ, and the minutest hairs clothing the setæ of the antennæ, &c.

The food of these little creatures consists of dead animal matter, Confervæ, &c. Straus says he never saw them attack living animals when they were well and strong, but he has frequently seen them attack worms, &c., when wounded and weak. Though dead animal matter was their choice, they will not, he adds, eat it when putrid. They no doubt also prey on each other, as I have often observed individuals of one species devouring eagerly the dead carcases of species different from themselves. When the ponds and ditches in which they live, dry up in summer, they bury themselves in the mud, and thus preserve their lives as long as the mud retains any moisture, becoming active as ever when the rain falls and again overflows their habitations. After long-continued drought, however, when the mud becomes very dry and hard, they perish; but the eggs do not perish along with the parents, for they can be hatched in four or five days after being placed in water.

These little creatures seem to be very lively in their native element, being almost constantly in motion, either swimming about rapidly by the action of their antennæ, or walking upon the plants and other solid bodies floating in the water. Instead of being fixed to one place, and condemned to live amidst eternal darkness, like the molluscous animals to which they bear such resemblance in external covering, "they" to use the words of Müller, "by opening their valves, enjoy light, and move at their will, sometimes burying themselves in the mud, sometimes darting through the water, the humid air of their sphere. If they meet any unforeseen object, they conceal themselves all at once in their shells and shut the valves, so that force and address seek in vain to open them."

This family contains two Genera.

1. Cypris.—Inferior or pediform antennæ provided with a pencil of long hairs or filaments. Animal swimming freely in the water.

2. Candona.—Inferior or pediform antennæ destitute of the pencil of long hairs or filaments. Animal creeping on the ground or upon plants.

Genus 1—Cypris.

Cypris, *Müller, Latreille, M. Edwards, Dana, &c.*
Monoculus, *Linnæus, Manuel, &c.*
Monocles à coquille bivalve, *Jurine.*

Character.—One eye. Two pairs of feet; one pair always inclosed within the shell. Abdomen terminated by a long, slender, bifid tail. Posterior or pediform antennæ furnished with a bundle of long setæ, generally plumose. Animal swims freely in the water.

1. CYPRIS TRISTRIATA. Tab. XVIII, figs. 1, 1 *a-i*; 2, 3.

CYPRIS TRISTRIATA, *Baird*, Trans. Berw. Nat. Club, i, 99, t. 3, f. 13, 1835; and ii, 152.
CYPRIS PUBERA, *Baird*, Mag. Zool. and Bot., i, 524, t. 16, f. 1-13.

Shell of an oval form, and somewhat reniform; the valves convex, and of a green colour, more or less deep. The anterior portion is of a deep green, immediately behind which is a portion of a lighter colour; the posterior part is of a less deep green, and has three narrow bands or streaks, two of which are of a much deeper hue, running obliquely across it. The whole shell is covered with dense, short hairs.

In some specimens, generally the largest, the shell is of nearly a dirty black colour, from the dirt which adheres to it obscuring the marks which distinguish the species. Nearly in the centre of each valve is to be seen a congeries of about seven small, lucid spots. The filaments of both pairs of antennæ are beautifully plumose.

Hab.—Berwickshire; near London, &c.; not uncommon, all the summer months.

2. CYPRIS VIDUA. Tab. XIX, figs. 10, 11.

CYPRIS VIDUA, *Müller*, Zool. Dan. Prod., No. 2384, 1776; Entomostraca, 55, t. 4. f. 7-9.
— *Latreille*, Hist. Nat. Crust., iv, 245.
— *Bosc*, Man. d'Hist. Nat. Crust., ii, 297.
— *Desmarest*, 385, t. 55, f. 4.
— *Baird*, Mag. Zool. and Bot., i, 133, t. 5, f. 1; Trans. Berw. Nat. Club, ii, 152.
— *M. Edwards*, Hist. Nat. Crust., iii, 399, t. 36, f. 4.
MONOCULUS VIDUUS, *Gmelin*, Linn. Syst. Nat., 3002, No. 42.
— *Manuel*, Enc. méth., vii, 726, No. 36, t. 264, f. 24-26.
— *Jurine*, Hist. Nat. Monoc., 175, t. 19, f. 5, 6.
— *Rees*, Cyclopædia, art. Monoculus.
MONOCULUS VIDUATUS, *Fabricius*, Ent. Syst., ii, 496.

Shell of an oval form, a little sinuated on under margin, and beset all round with dense, fine, short hairs. The colour is a dull white, and the valves are distinctly marked with three black, somewhat waved fasciæ, running transversely across the shell at unequal distances, the most anterior of the three being the smallest. Posterior margin rather narrower than anterior.*

Hab.—Neighbourhood of London, Rugby, &c. &c.; common during the summer months.

3. CYPRIS MONACHA. Tab. XVIII, fig. 6.

CYPRIS MONACHA, *Müller*, Zool. Dan. Prod., No. 2390, 1776; Entomostraca, 60, t. 5, f. 6-8.
— *Latreille*, Hist. Nat. Crust., iv, 247.
— *Bosc*, Man. d'Hist. Nat. Crust., ii, 297.
— *Desmarest*, Consid. gén. et part. des Crust., 384, t. 55, f. 7.
— *Baird*, Mag. Zool. and Bot., i, 133, t. 5, f. 2; Trans. Berw. Nat. Club, ii, 152.
— *M. Edwards*, iii, 397.
— *Koch*, Deutsch. Crustac., h. ii, t. 1.
MONOCULUS MONACHUS, *Gmelin*, Linn. Syst. Nat., 3003, No. 44.
— *Manuel*, Enc. méth., vii, 727, No. 41, t. 266, f. 34-36.
— *Fabricius*, Ent. Syst., ii, 497.
— *Rees*, Cyclopæd., art. Monoc.
— *Jurine*, Hist. Nat. Monoc., 173, t. 18, f. 13, 14.
CYPRIS NUBILOSA (?), *Koch*, Deutsch. Crustac., h. xii, t. 4.

Shell of a rhomboidal form, rounded at posterior margin, and truncated as it were anteriorly; glabrous, with a few hairs on posterior margin. The surface of the shell is reticulated, or, as Müller says, marked with small points impressed into, or as it were excavated out of, the shell. The upper part is nearly of a white colour, while the lower portion of anterior margin, and part of posterior, are very dark, shaded with a yellow green. The filaments of posterior antennæ are long.

A very pretty and well-marked species.

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* It is not so narrow at the posterior extremity as is represented by Jurine. Müller's figure represents the anterior extremity as the narrower.

Hab.—Neighbourhood of London, July, August, and September. Old canal at Rugby; Newnham Loch, Northumberland, Dr. Johnston.

4. Cypris fusca. Tab. XIX, fig. 7.

Cypris fusca, *Straus*, Mém. Mus. Hist. Nat., vii, t. 1, f. 16, 1821.
— *Desmarest*, Consid. gén. et part. Crust., 384.
— *M. Edwards*, Hist. Nat. Crust., iii, 401, t. 36, f. 3.
— *Baird*, Mag. Zool. and Bot., i, 134, t. 5, f. 4; Trans. Berw. Nat. Club, ii, 152.
— *Guerin*, Iconog. Règne An. Crust., t. 32, f. 4.

Shell oval, of a uniform brown colour, sinuated on under margin. The anterior extremity is narrower than the posterior, which is rounded and broad. The valves are covered with fine hairs. Filaments of posterior antennæ only three in number, and rather short.

Hab.—Neighbourhood of London; Hampstead, &c., June, July, and August.

5. Cypris compressa. Tab. XIX, figs. 14, 14 *a-c*.

Cypris compressa, *Baird*, Trans. Berw. Nat. Club, i, 100, t. 3, f. 16, 1835, and ii, 152; Mag. Zool. and Bot., i, 136, t. 5, f. 7.
— *M. Edwards*, Hist. Nat. Crust., iii, 400.
Cypris punctata, *Koch*, Deutsch. Crustac., h. xxi, t. 23, 1838.
(*Not* Cypris compressa, *Koch*, l. c. t. 17.)
Cypris tenera, *Koch*, l. c., h. xii, t. 3.

Shell of a rounded form, but compressed, narrower anteriorly than posteriorly, of a brownish-gray colour, more or less deep, semi-transparent, beset at both extremities with fine hairs. In general the surface of the shell is spotted, as if from little pieces being hollowed out of its substance. Eye large. Filaments of posterior antennæ, three long and one short. From the thin, compressed shape of the shell, the motion of the little animal through the water is very much like that of some of the Lynceidæ.

Hab.—Yetholm Loch; neighbourhood of London; Rugby, &c.; common from May to January.

6. Cypris minuta. Tab. XVIII, figs. 7, 8.

Cypris minuta, *Baird,* Trans. Berw. Nat. Club, i, 99, t. 3, f. 9, 1835, and ii, 152; Mag. Zool. and Bot., i, 136, t. 5, f. 11.
— *M. Edwards,* Hist. Nat. Crust., iii, 403.
Monoculus ovum (?), *Jurine,* Hist. Nat. Monoc., 179, t. 19, f. 18, 19.

Shell oval, broader posteriorly than anteriorly, elevated and rounded on upper margin, slightly sinuated on under edge, of a light-brown colour, with a tinge of green. The valves are smooth and shining in the centre, and beset all round with short hairs. This is the smallest of all the species I have yet met with, and approaches very near to *Monoc. ovum* of Jurine, except that he says his species is perfectly smooth, whereas this is beset all round the shell with fine hairs.

Hab.—Yetholm; neighbourhood of London, &c., summer months.

7. Cypris Joanna. Tab. XVIII, fig. 5.

Cypris Joanna, *Baird,* Trans. Berw. Nat. Club, i, 99, t. 3, f. 8, 1835, and ii, 152; Mag. Zool. and Bot., i, 136, t. 5, f. 12.
— *M. Edwards,* Hist. Nat. Crust., iii, 403.

Shell rounded ovate, narrower anteriorly than posteriorly, of a brown colour, with an orange mark across the back of shell and the lower margin. Shell beset all round with rigid hairs, and covered with minute black points or dots. Approaches the *C. pilosa* of Müller, but is smaller, and is otherwise distinguished from it by the orange mark across the back, and by not being glabrous, but marked all over with black, roughish-looking points. It is a little longer than *C. minuta.*

Hab.—Pool of water on one of the Lammermuir hills, near Abbey St. Bathans, Berwickshire, August 1835.

8. Cypris elongata. Tab. XIX, fig. 6.

Cypris elongata, *Baird,* Trans. Berw. Nat. Club, i, 99, t. 3, f. 10, 1835, and ii, 152; Mag. Zool. and Bot., i, 137, t. 5, f. 13.
— *M. Edwards,* Hist. Nat. Crust., iii, 401.

Shell wedge-shaped; anterior extremity much broader than posterior, which is narrow and much elongated. The valves are elevated on the upper margin, towards the anterior extremity, and situated on the under edge; they are white, transparent, and hairy.

Hab.—At Yetholm, Roxburghshire, July 1835.

9. Cypris Westwoodii. Tab. XIX, fig. 9.

Cypris Westwoodii, *Baird,* Trans. Berw. Nat. Club, i, 99, t. 3, f. 12, 1835, and ii, 152; Mag. Zool. and Bot., i, 137, t. 5, f. 14.
— *M. Edwards,* Hist. Nat. Crust., iii, 400.

Shell reniform, much elevated, and rounded on upper margin, deeply sinuated underneath; rather broader at anterior extremity, of a green colour, and semi-transparent. The valves are covered all over with rather long hairs, and the filaments of posterior antennæ are very long.

Hab.—Yetholm Loch, Roxburghshire, July 1835.

10. Cypris gibbosa. Tab. XIX, fig. 8.

Cypris gibbosa, *Baird,* Mag. Zool. and Bot., i, 137, t. 5, f. 15, 1837; Trans. Berw. Nat. Club, ii, 152.
— *M. Edwards,* Hist. Nat. Crust., iii, 401.

Shell ovate, and much elevated on the upper margin, the centre exhibiting a large gibbosity or hump; sinuated underneath. The valves are smooth, except round the edges, which are beset with short, fine hairs, are nearly opaque, and of a light green colour, the anterior extremity being paler than the other parts of the shell. Filaments of both pairs of antennæ beautifully plumose.

Hab.—Ditch near the Surrey Zoological Gardens, June 1836.

11. CYPRIS CLAVATA. Tab. XVIII, fig. 4.

CYPRIS CLAVATA, *Baird*, Mag. Zool. and Bot., i, 137, t. 5, f. 16, 1837;
Trans. Berw. Nat. Club, ii, 152.
— *M. Edwards*, Hist. Nat. Crust., iii, 405.

Shell oblong, narrower at posterior extremity than anterior, which is rather flattened, giving the shell the appearance of being club-shaped. The valves have the upper margin elevated, and the lower nearly straight. They are smooth and shining, but beset round the margin with short hairs; their colour is of a light gray, with an obscure dark-coloured ray running from the centre towards the posterior extremity, which again is distinctly marked with an orange-coloured spot.

The antennæ and feet are short, compared with the size of the shell. The filaments of both pairs of antennæ are plumose.

This species approaches near to *C. crassa* of Müller, as described by him; but differs *in toto* from the figure which he gives of it.

Hab.—In a pond near Copenhagen Fields, July 1836.

12. CYPRIS STRIGATA.

CYPRIS STRIGATA, *Müller*, Zool. Dan. Prod., 199, 2387, 1776;
Entomostraca, 54, t. 4, f. 4-6.
— *Ramdohr*, Beyt. zur Naturg., 14-17, t. 4, f. 1-14.
— *Latreille*, Hist. Nat. Crust., iv, 245.
— *Desmarest*, Cons. gén. et part. Crust., 386.
— *Bosc*, Man. d'Hist. Nat. Crust., ii, 297.
— *Baird*, Trans. Berw. Nat. Club, i, 99, ii, 152;
Mag. Zool. and Bot., i, 132.
MONOCULUS STRIGATUS, *Gmelin*, Linn. Syst. Nat., 3002, 37.
— *Fabricius*, Ent. Syst., ii, 496.
— *Manuel*, Enc. méth., vii, 726, No. 31.
— *Rees*, Cyclopædia, art. Monoc.
MONOCULUS BISTRIGATUS, *Jurine*, Hist. Nat. Mon., 177, t. 19, f. 12, 13.
— *M. Edwards*, Hist. Nat. Crust., iii, 403.

"Shell subovate, glabrous; ciliated at the margins, sublinear at the aperture; valves rather convex, brown, with three white fasciæ, the posterior one lunated, the middle oblique, and the anterior arched; or it may be described, valves white on dorsal margin, bound by a brown belt, with two oblique brown spots in the disc."—*Müller.*

Hab.—Pool on seashore, a little above high-water mark, at Thornton Loch, East Lothian, June 1835.

13. Cypris elliptica. Tab. XIX, fig. 12.

Cypris elliptica, *Baird,* Trans. Berw. Nat. Club, ii, 152, 1846; Ann. and Mag. Nat. Hist., xvii, 414, t. 9, f. 2.

Shell nearly elliptical, of a light green colour, clouded with darker patches of the same colour on the sides of the shell. Valves glabrous, except round the edges, which are beset with short hairs. Filaments of posterior antennæ long.

Hab.—Pond at Highgate; July 1846.

14. Cypris sella. Tab. XIX, figs. 5, 5 *a.*

Cypris sella, *Baird,* Trans. Berw. Nat. Club, ii, 152, 1846; Ann. and Mag. Nat. Hist., xvii, 414, t. 9, f. 3.

Shell ovate globose, of a uniform light green colour, marked on the back and side with a patch of a darker hue. A dark streak runs along the upper edge of the shell, beginning from immediately behind the eye, and terminating at about the same distance from the posterior extremity. It then extends a short way down the side, and then runs forward a little way in a somewhat lunated shape. At the anterior commencement of the dorsal mark a narrower streak of the same colour runs down the side, stopping only a short distance from the anterior margin. The shell is densely beset all round with short hairs.

This species resembles a little the *Cypris vidua* in shape, but is smaller, and differs very considerably in the markings, which are uniformly the same.

Hab.—Pond on Clapham Common, July 1846.

15. CYPRIS AURANTIA. Tab. XIX, fig. 13.

MONOCULUS AURANTIUS, *Jurine,* Hist. Monoc., 173, t. 18, f. 5-12.
CYPRIS AURANTIA, *Desmarest,* Cons. gén. Crust., 384.
— *M. Edwards,* Hist. Nat. Crust., iii, 402.

Shell oval, rounded on dorsal margin, slightly sinuated on ventral margin; beset all round with short hairs. Anterior extremity rather narrower than posterior. The shell is of a finely polished appearance, and of an orange colour. On the posterior half it is marked with a rather broad band of a lighter hue, running obliquely across; the darker portions of the shell, on each side of it, terminating abruptly in a marked line of a deeper colour than the general shade of the rest of the shell.

Hab.—Blackheath, June. Windsor Great Park, July. Dover, September 1849.

Genus 2—CANDONA.

Character.—Externally resembling Cypris; but the inferior or pediform antennæ are destitute of the pencil of long hairs which characterise that genus. The animal creeps at the bottom or upon aquatic plants, instead of swimming freely through the water.

The genus Cypris, as established by Müller, had, up to 1845, remained intact. As, however, a number of the species which have been described possess a set of organs which many others do not, and which exercise a decided influence upon their economy and habits, I thought it became incumbent to separate the two sets of species into distinct genera. In the one series the animals have a much greater degree of motion and agility than the others, swimming freely and rapidly through the water in all directions, and apparently possessing a higher degree of enjoyment in their existence. This arises from the bundle of long plumose setæ which spring from the second articulation of the posterior or pediform antennæ described above (p. 145), and by means of which they can suspend themselves in the water, or transport themselves through it with great facility. For this set I have retained the name of

Cypris. The others are deficient in this apparatus, and instead of swimming gaily through the limpid element, crawl in the mud at the bottom of the pools in which they are found, or creep along the aquatic plants which grow there, and if dropped into a glass of water, fall to the bottom, without being able to suspend themselves for the shortest time. These constitute the genus Candona, which I first published in the 'Trans. Berw. Nat. Club,' ii, p. 152, 1845, and afterwards in the 'Ann. and Mag. Nat. Hist.,' xvii, p. 414.*

1. CANDONA LUCENS. Tab. XIX, fig. 1.

CYPRIS LUCENS, *Baird*, Trans. Berw. Nat. Club, i, 100, t. 3, f. 15, 1835.
CYPRIS CANDIDA, *Baird*, Mag. Zool. and Bot., ii, 134, t. 5, f. 3.
CANDONA CANDIDA, *Baird*, Trans. Berw. Nat. Club, ii. 153, 1845.
CYPRIS PELLUCIDA, *Koch*, Deutsch. Crust., h. xi, t. 5, 1837.
CYPRIS LUCIDA (?), *Koch*, Deutsch. Crust., h. xxi, t. 18, 1838.

Shell somewhat reniform, arched on the upper margin, and sinuated underneath. The valves are ventricose in the middle, smooth, except round the edges, which are fringed with fine short hairs, shining, of a pure white colour, with a pearly lustre, and nearly opaque. The anterior extremity is narrower and flatter than the posterior, which is prominently arched on the upper angle, and prolonged inferiorly to a short point.

Hab.—Neighbourhood of London, Cockburnspath, Yetholm, &c.; summer and autumn months.

2. CANDONA REPTANS. Tab. XIX, figs. 3, 3*a*.

CYPRIS REPTANS, *Baird*, Trans. Berw. Nat. Club, i, 99, t. 3, f. 11, 1835;
Mag. Zool. and Bot., ii, 135, t. 5, f. 5.
— *M. Edwards*, Hist. Nat. Crust., iii, 400.
CANDONA REPTANS, *Baird*, Trans. Berw. Nat. Club, ii, 153, 1845.

Shell ovate elliptical, nearly plane on upper margin, and slightly sinuated underneath. The valves are rather prominent or gibbous in the centre, and glabrous, the edges being fringed with rather long hairs. The colour is of a light whitish-green, variegated with marks on the anterior and posterior margins; and on the sides, of the same colour, but of a deeper hue.

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* For further characters of this genus, see the forthcoming monograph of the 'Entomostraca of the Cretaceous Formation of England,' by T. Rupert Jones, Esq., publishing by the Palæontographical Society.

Hab.—Neighbourhood of London, summer months. Yetholm Loch; Newnham Loch, Northumberland, Dr. Johnston.

3. CANDONA HISPIDA. Tab. XIX, fig. 4.

CYPRIS HISPIDA, *Baird*, Trans. Berw. Nat. Club, i, 99, t. 3, f. 14, 1835; Mag. Zool. and Bot., ii, 135, t. 5, f. 6.
— *M. Edwards*, Hist. Nat. Crust., iii, 405.
CANDONA HISPIDA, *Baird*, Trans. Berw. Nat. Club, ii, 153, 1845.

Shell oval, rather ventricose, the anterior extremity a little broader than the posterior. The colour is a uniform brown, with one or two marks of a deeper hue running across the centre; both extremities partaking of the same dark shade. The valves are very hispid, their surface being covered with spines rather than hairs.

Hab.—Neighbourhood of London; Yetholm. Summer months.

4. CANDONA DETECTA.

CYPRIS DETECTA, *Müller*, Zool. Dan. Prod., No. 2386, 1776; Entomostraca, 49, t. 3, f. 1-3.
— *Bosc*, Man. d'Hist. Nat. Crust., ii, 295.
— *Latreille*, Hist. Nat. Crust., iv, 241.
— *Leach*, Edinb. Encyc. art. Crust., vii, 388.
— *Baird*, Mag. Zool. and Bot., i, 525.
— *Lamarck*, Hist. An. s. Vert., v, 124.
MONOCULUS DETECTUS, *Gmelin*, Linn. Syst. Nat., 3001, No. 36.
— *Manuel*, Enc. méth., vii, 725, No. 30, t. 266, f. 15-17.
— *Rees*, Encyclop., art. Monoculus.
SMOOTH WHITE INSECT, *Müller*, Phil. Trans., lxi, 230, t. 7, f. 1-3.
CANDONA DETECTA, *Baird*, Trans. Berw. Nat. Club, ii, 153, 1845.

Shell oblong oval; the anterior extremity rather narrower than posterior, upper margin slightly arched, and inferior edge somewhat sinuated. The valves are flatter than in almost any other species, pellucid, and quite smooth. The colour is of a dull white, without any spots or marks. The *C. detecta* of Müller is quite a different species from the *Monoc. conchaceus* of Jurine, though that author quotes them as synonymous, in which, though with hesitation, he is followed by M. Edwards. These synonyms, therefore, as quoted by me in the 'Mag. Zool. and Bot.,' must be expunged.

Hab.—Neighbourhood of London; Pool on Beaumont Water, &c.; not common.

5. CANDONA SIMILIS. Tab. XIX, figs. 2, 2*a*.

CANDONA SIMILIS, *Baird*, Trans. Berw. Nat. Club, ii, 153, 1845; Ann. and Mag. Nat. Hist., xvii, 415, t. 9, f. 4.

Shell somewhat elliptical in figure, flat, slightly sinuated in the middle of the lower margin, and nearly plane on dorsal edge. The colour is white, with two dark-orange spots on the back. The valves are smooth, except round the edges, which are fringed with rather stiff hairs; these are more numerous on anterior extremity than on posterior. The shell is narrower posteriorly than anteriorly, and is transparent. Its motion is very deliberate, when it walks along the plants, first putting one foot forward, and then leisurely drawing up the other. It approaches near to the *C. detecta* of Müller; the posterior extremity, however, is narrower than anterior, which is the reverse in the *detecta*.

Hab.—Pond on Clapham Common, July 1846.

Family II—CYTHERIDÆ.

CYTHERINEN, *Roemer*, Jahrbuch, 1838.

Character.—Two pairs of antennæ; superior not furnished with the pencil of long filaments. Feet, three pairs.

This family contains two British genera—CYTHERE and CYTHEREIS.

Genus 1—CYTHERE.

CYTHERE, *Müller, Latreille, Desmarest, M. Edwards, &c. &c.*
CYTHERINA, *Lamarck, Sowerby, Munster, Roemer, &c. &c.*
CYPRIDINA, *Bosquet* (not *M. Edwards*).
BAIRDIA, *M'Coy, Jones.**

Character.—One eye. Three pairs of feet; all external, none being inclosed within the shell. Abdomen short. Inferior or pediform antennæ furnished with one tolerably long, curved and jointed filament. Superior antennæ simple, setiferous, and not provided with any pencil of long filaments.

Bibliographical History.—Before Müller's time the animals of this genus were perfectly unknown, not the slightest mention of their existence having been made by any previous writer. As he is the first who has noticed them, so he is the only author to whom we can refer for any information respecting them, with the exception of what I have added in my paper in the 'Mag. of Zool. and Botany' for August 1837. Upon a slight inspection the Cytheres might be mistaken for Cyprides; but their superior antennæ, being simple and free from the pencil of long hairs with which these organs in the Cypris are endowed, their possessing three pairs of feet, all of which project out of the shell, and the want of the long tail or abdomen, sufficiently distinguish the two genera. It is in his 'Entomostraca' that Müller first established the genus, and the above marks of distinction between it and the Cypris constitute almost all the knowledge that he imparts to us concerning it. Meagre as it is in its details, it has not been enlarged by any succeeding author.

Gmelin, in the 'Syst. Nat.,' 1788, Fabricius, in his 'Ent. Syst.,' 1793, Manuel, in the 'Encyc. méth.,' 1792, Latreille, in his 'Hist. Nat. Crust. et Ins.,' 1802, either merely give the species alone, or repeat the few remarks made by Müller, without making any comment or original observations of their own. Lamarck, in his 'Anim. s. Vert.,' 1818, changes Müller's name, and gives the genus the appellation of Cytherina, while Desmarest, in his 'Cons. sur Crust.,' 1825, in repeating the observations made by Müller, and giving merely his species, adds, that it may turn out that some of the feet may be particular organs, and that the number may be found to be the same as in the Cypris,—a conjecture which Latreille also makes in the last edition of Cuvier's 'Règne Anim.,' 1829. Desmarest moreover says, "reasoning from analogy, we are led to believe that the Cythere, like the Cypris, has branchial plates attached to the mandibles and jaws, and that their feet are solely destined for locomotion." *

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* The animal, in those recent species which have been referred by Mr. Jones to the sub-genus BAIRDIA, *M'Coy*, and which I have had an opportunity of examining, does not differ in the least from the animal of the Cythere proper.

Anatomy and Physiology, &c.—The shell in almost every respect strictly resembles that of the Cypris; but from its general opacity and minuteness it is exceedingly difficult to examine with precision the body of the inclosed animal. After repeated attempts, however, to break down the horny opaque shell I succeeded so far as to discover that, like the Cypris, the body is divided into two parts connected with each other by a narrow space; the anterior or thoracic portion containing the eye, the superior and inferior antennæ, organs of mouth, and two pairs of feet; the posterior or abdominal portion, containing the third pair of feet, and a short appendix or tail.

The eye resembles in appearance and situation that of the Cypris, being single, fixed, and in form of a black sessile point.

The superior antennæ (t. XX, f. 5 *b*) are composed each of seven joints, furnished with one or two short setæ at the base of each of the four last articulations, and terminated by several rather longer hairs at the extremity of the last joint, differing materially in this respect from the same organs in the Cypris. The inferior antennæ (t. XX, f. 5*e*) are inserted immediately beneath these, and are by far the stronger of the two. They differ considerably in shape from the superior ones, being flatter, falcated in appearance, and as in the Cypris and Candona, more like feet than antennæ. They consist of five articulations; the first and third being very short. The last gives off on internal edge, three spines, and is terminated by a tuft of stout setæ, as in the Candona, while from the base of the second joint there springs a long, stiff seta, equalling in length the last two joints, and being divided into three articulations, of which the middle is the longest. This seta is mentioned by Müller as occurring in the *Cythere lutea*, and is taken notice of by him as being peculiar to it, or at best as not having been seen in any other species. It occurs, however, in all that I have examined, and seems to take the place of the pencil of long hairs that is to be found on the penultimate joint of the corresponding organs in the genus Cypris, but the precise use of which I do not understand. These organs are, as in the Cypris and Candona, directed backwards.

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* Cons. gén. et part., &c., p. 387.

The feet (t. XX, f. 4*d*, 5*f*) are three pairs in number, and are all exactly like each other, except in length. They are round and slender, and consist each of five articulations, the second of which is the largest, and gives off a short spine from its base. The last is the shortest, and is terminated by one or two long, curved hooks, or strong setæ. They are all directed forwards. The first of these three pairs is very short; the second a little longer; whilst the third, or last pair, is the longest of all, being longer than the inferior antennæ, though much more slender. This last or posterior pair (f. 5*f*) appears to arise from near the junction of the two halves of the body, and may supply, as Müller says, the want of the tail.

The mouth is situated in the inferior surface of the anterior half of the body, as in the Cypris, and appears to consist of exactly the same organs as in the animals of that genus, though, from their extreme minuteness and want of lengthened opportunities for examination, I have not been able to make out all the parts. The palpiferous mandibles, and the first pair of jaws with their branchial plates, are the only parts I have clearly distinguished, and they resemble in almost every respect the corresponding organs of the Cyprides.

The mandible (t. XX, f. 5*c*) is formed of two pieces : the larger of the two, or proper mandible, as in the Cypris, being terminated at the superior extremity by a sharp point, and at the lower or incisive extremity by about six or eight pretty strong teeth ; while the other part, the palpus, consists of three or four joints, plentifully supplied at the extremities of the articulations with numerous setæ, and a small branchial plate of one joint attached to the first articulation. The first pair of jaws (t. XX, f. 5 *d*), as in the Cypris, consists also of two parts, the square plate, with the four fingers, the superior of which has two joints, while the others have only one, and are all terminated by a tuft of setæ ; and the branchial plate attached, of an elongated oval form, furnished with fourteen long setæ, which are given off from both sides. As these organs are so very similar to the corresponding organs in the Cypris, I have no doubt that the other parts (the lips and second pair of jaws) are also alike, and therefore that the supposition of Desmarest, with respect to some of the intermediate feet being peculiar organs, is incorrect, and that as their use and situation indicate, they are all true feet, and used solely for locomotion, the posterior pair perhaps serving, in addition, one of the uses of the tail of the Cypris, that of cleaning the inside of the shell, for which they are well adapted, from their length and the great degree of mobility they possess.

The appendix, or short tail, is of such an irregular figure, that until better opportunities occur for examination, I shall not attempt a minute description. The internal anatomy I have not succeeded in making out at all, neither have I ever seen any individual with ova, though this may perhaps be accounted for, from the specimens which I have examined being chiefly dissected in the winter months.

These little creatures are chiefly to be found in sea-water, and may be met with in all the little pools among the rocks on the seashore. They live among the Fuci and Confervæ, &c., which are to be found in such pools; and the naturalist may especially find them in abundance in those beautiful, clear, little, round wells which are so frequently to be met with, hollowed out of the rocks of the seashore, which are within reach of the tide, and the water of which is kept sweet and wholesome, by being thus changed twice during every twenty-four hours. In such delightful pools, clear as crystal, when left undisturbed by the receding tide, these interesting animals may be found, often in great numbers, sporting about amongst the Confervæ and Corallines, which so elegantly and fancifully fringe their edges and decorate their sides, and which form such a glorious subaqueous forest for myriads of living creatures to disport themselves in. Sheltered amongst the "umbrageous multitude" of stems and branches, and nestling in security in their forest glades, they are safe from the ravages of the advancing tide, though lashed up to fury by the opposing rocks which for a moment check its advance; and weak and powerless though such pigmies seem to be, they are yet found as numerous and active in their little wells, after the shores have been desolated by the mighty force of the tide, which has been driven in in thunder by the power of a fierce tempest, as when the waves have rolled gently and calmly to the shore in their sweetest murmurs. Hitherto they have been found very sparingly in fresh water, two species only having been noticed.

These animals have never been seen to swim, invariably walking among the branches or leaves of the Confervæ or Fuci, &c., where they delight to dwell. When shook out from their hiding-places into a bottle or tumbler of water, they may be seen to fall in gyrations to the bottom, without ever attempting to dart through the watery element, as is the case with the Cyprides. Upon reaching the bottom, they open their shells and creep along the surface of the glass; but when touched or shook, they immediately again withdraw themselves within their shell, and remain motionless. This inability to swim is no doubt owing to the want of the pencils of long hairs or filaments which adorn the superior and inferior antennæ of the Cyprides, and which we have already seen are the organs by means of which they swim. My opportunities for observing these tiny animals have been so limited, and the difficulty of keeping them alive, from the rapidity with which sea-water becomes putrid when kept in a room in a small vessel, is so great, that I cannot make any additional statements respecting their economy or habits. The species, however, are undoubtedly numerous, and the labours of any inquirer after them would assuredly be rewarded with much success.

1. Cythere flavida. Tab. XXI, figs. 12, 12 *a*.

Cythere flavida, *Müller*, Entomost., 66, t. 7, f. 5, 6, 1781.
— *Latreille*, Hist. Nat. Crust., iv, 253.
— *Desmarest*, Consid. gén. et part. Crust., 388.
— *Bosc*, Man. d'Hist. Nat. Crust., ii, 284.
— *Baird*, Mag. Zool. and Bot., ii, 142; Trans. Berw. Nat. Club, ii, 153.
Monoculus flavidus, *Gmelin*, Linn. Syst. Nat., 3001, No. 33.
— *Fabricius*, Ent. Syst., ii, 494.
— *Manuel*, Enc. méth., vii, 725, t. 266, f. 10, 11.
— *Rees*, Cyclopæd. art. Monoculus.

Shell oblong, narrow, anterior extremity more acute than posterior; smooth, shining, of a pale yellow horn colour, and transparent. Inferior margin nearly straight; superior arched.

Hab.—Among Confervæ in pools of sea-water at Cocksburnspath, Berwickshire, 1835. In sand, from Torquay; W. C. Williamson, Esq.

2. **Cythere reniformis.** Tab. XX, figs. 5, 5 *a-f*.

Cythere reniformis, *Baird*, Trans. Berw. Nat. Club, i, 98, t. 3, f. 5, 1835; and ii, 153; Mag. Zool. and Bot., ii, 142, t. 5, f. 16-22.
— *M. Edwards*, Hist. Nat. Crust., iii, 408.

Shell reniform, rough with hairs; both extremities of nearly equal size, anterior a little flatter than posterior. The centre of the valves is covered with a calcareous-looking crust, which is rather of a darker colour than the rest of the shell, and appears studded all over with short spines. The colour of the shell is of a light brownish yellow; and the legs and antennæ of the animal are brightly marked with the same hue.

It approaches the *C. lutea*, Müll., in shape; but differs somewhat in colour, in being roughly hairy, and having the valves covered with the hard crust.

Hab.—Coast of Berwickshire; at Cockburnspath, Berwick, &c., 1835. N. Foreland, near Dover, August and September, 1849.

3. **Cythere albo-maculata.** Tab. XX, fig. 7.

Cythere albo-maculata, *Baird*, Mag. Zool. and Bot., ii, 142, t. 5, f. 23, 1838; Trans. Berw. Nat. Club, ii, 153.
— *M. Edwards*, Hist. Nat. Crust., iii, 408.

Shell oblong, a little flatter at the anterior extremity, gently rounded on the upper margin, and deeply sinuated on the lower, near the anterior extremity. Both the extremities and the lower margin are densely hairy. The central portion of the valves is covered with a calcareous-looking crust, as in the last species, and is studded all over with short spines, except where it is marked with two white, smooth, shining spots of considerable size. The colour of the shell is altogether of a dull brown.

Hab.—Berwick Bay, 1835; not very common; near Dover, September 1849.

4. CYTHERE ALBA. Tab. XX, fig. 6.

CYTHERE ALBA, *Baird*, Trans. Berw. Nat. Club, i, 98, t. 3, f. 6, 1835, and ii, 153; Mag. Zool. and Bot., ii, 143, t. 5, f. 24.
— *M. Edwards*, Hist. Nat. Crust., iii, 409.

Shell obovate, the anterior extremity much broader than the posterior, fringed round the edges with short hairs. The colour is white, and a margin extends all round the outer edge still whiter than the body of the shell. The valves are transparent, showing the dark body of the insect shining through.

Hab.—Sea-shore at Dunbar, East Lothian, 1835.

5. CYTHERE VARIABILIS. Tab. XXI, figs. 10, 11.

CYTHERE VARIABILIS, *Baird*, Trans. Berw. Nat. Club, i, 98, t. 3, f. 7, *a*, *b*, 1835, and ii, 153,; Mag. Zool. and Bot., ii, 143, t. 5, f. 25, *a*, *b*.
— *M. Edwards*, Hist. Nat. Crust., iii, 409.

Shell oval, the anterior extremity considerably narrower than the posterior, glaucous, without hairs. This species varies much in colour and markings; some individuals are white, with two black fasciæ running transversely across the shell, one at the posterior margin, the other across the centre of the valves, while the posterior extremity is marked besides by a beautiful reddish or bright bronze spot. Others are of a light flesh colour, with the edges of the shell slightly greenish, and the central portion marked with dark streaks running across. Some again are altogether of a fine flesh colour, without any marks upon the valves, while others are of a uniform dark brown or almost black hue. All these varieties, however, agree in shape, size, &c.

Hab.—Coast of Berwickshire; common; Dover, Sept. 1849.

6. CYTHERE AURANTIA. Tab. XXI, fig. 8.

CYTHERE AURANTIA, *Baird*, Mag. Zool. and Bot., ii, 143, t. 5, f. 26, 1835; Trans. Berw. Nat. Club, ii, 153.
— *M. Edwards*, Hist. Nat. Crust., iii, 408.

Shell somewhat reniform, rounded and rather prominent on upper margin; slightly sinuated underneath, the posterior extremity rather broader than the anterior. The valves are smooth, glaucous, and of a bright orange colour. This species is very minute.

Hab.—Berwick Bay; 1835.

7. CYTHERE NIGRESCENS. Tab. XXI, figs. 4, 4 *a*.

CYTHERE NIGRESCENS, *Baird*, Mag. Zool. and Bot., ii. 143, t. 5, f. 27, 1838; Trans. Berw. Nat. Club, ii, 153.
— *M. Edwards*, Hist. Nat. Crust., iii, 409.

Shell gibbosely ovate, anterior extremity rounded, narrower than posterior, which is marked by a gibbous projection above and below, and is terminated by a sharp point. The valves are quite smooth and free from hairs, of a dirty, black colour, and translucent, showing the body of the animal, which is of a very dark hue, shining through.

Hab.—Berwick Bay; not uncommon; 1835. Dover, September 1849. Arran, Boston, &c., in sand; W. C. Williamson, Esq.

8. CYTHERE MINNA. Tab. XX, figs. 4, 4 *a-d*.

BAIRDIA SILIQUA (*var. c.*?), *T. R. Jones*, Entomost. of the Cretaceous Formation of England.

Shell elongate ovate, bluntly conical on the dorsal margin, nearly plain beneath; obtusely rounded on anterior extremity; sharply acute posteriorly, and narrow, the extremity of the shell being produced into an acute point. The valves are smooth, glabrous, white, and pellucid. This is totally different from any yet described, and is a very distinct species; it is the largest of all I have seen.

Hab.—Dredged in from eighty to ninety fathoms of sand; twenty miles east of the Noss in the Shetland Isles; R. M'Andrew, Esq.

9. CYTHERE INOPINATA. Tab. XX, figs. 1, 1 *a-c*.

CYTHERE INOPINATA, *Baird*, Zoologist, i, 195, f. *a*, *b*; Trans. Berw. Nat. Club, ii, 153.

Shell oblong ovate, nearly of equal size at each extremity; white, with a slightly orange-coloured mark on the upper edge; transparent, smooth, and shining; perfectly free from hairs, but possessing a few short, spinous projections on the lower margin of the posterior extremity. Each valve has a gibbous projection about the middle, which is best seen when the animal is lying on its back, and is sinuated on the interior margin.

The superior antennæ (f. 1 *b*) are composed of five (?) articulations, and furnished with several rather short setæ. The inferior or pediform antennæ (f. 1 *c*) are provided with a stout, jointed seta. This species is very small, and from this circumstance and its always creeping at the bottom, is easily overlooked.

This is the second species only that has as yet been found inhabiting fresh water, Mr. Say having previously described one as occurring in Georgia and East Florida. See 'Journ. Acad. Nat. Sc.,' Philad. 1817.

Hab.—The only place I have ever found this species is in a small pond between Hanwell and Southall, Middlesex.

10. CYTHERE ANGUSTATA. Tab. XXI, fig. 6.

CYTHERINA ANGUSTATA, *Munster*, Jahrbuch für Mineralogie, 1838, t. 6, f. 10.

Shell oval oblong, obtuse at either extremity, narrower anteriorly, and slightly sinuated on inferior margin. It is of a pale yellow colour, and the surface is shining and polished-looking, but when examined by the microscope, it is seen to be covered with small asperities. The substance of the shell is horny-looking and transparent. Along the dorsal margin, on each side, there is a series of indentations visible, which give it a kind of wrinkled appearance at that part.

Hab.—Devonshire, W. C. Williamson, Esq.* Tenby, T. Rupert Jones, Esq.

11. CYTHERE ACUTA. Tab. XXI, fig. 5.

Shell oval, convex, acute at both extremities, which are nearly of equal size, of a pale, horny hue, smooth, glaucous, transparent; upper margin considerably arched and rounded, the inferior one slightly so. In shape it somewhat resembles a grain of oats.

Hab.—Arran, in sand; W. C. Williamson, Esq.

12. CYTHERE PELLUCIDA. Tab. XXI, fig. 7.

Shell oblong, reniform, narrow; both extremities rounded and nearly of the same size with each other; pellucid, and of a white colour. The surface at first appears smooth and shining, but when examined with the microscope it is seen to be minutely dotted or punctated.

Hab.—Boston, in sand; W. C. Williamson, Esq.

13. CYTHERE IMPRESSA. Tab. XXI, fig. 9.

Shell oval, very convex, of much the same size at both extremities. The surface of the shell is covered with impressed punctations, and the colour is of a dull blackish hue. The substance is of considerable thickness.

Hab.—Torquay, in sand; W. C. Williamson, Esq.

14. CYTHERE QUADRIDENTATA. Tab. XXI, fig. 2.

Shell oval oblong, narrower at one extremity than the other; the longer extremity (the posterior) rounded and slightly crenulated or toothed; the narrower extremity (anterior) produced and terminating in four distinct prominent teeth. The shell is white, and the surface is grooved longitudinally, the grooves being marked with rows of impressed punctures.

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* I am glad of this opportunity of acknowledging the kind and liberal manner in which Mr. Williamson has placed his specimens of Ostracoda in my hands for description.

Approaches near CYTHERINA SCROBICULATA of *Munster*, vide *Roemer's* 'Cytherinen,' &c., in Jahrbuch für Mineral., 1838, t. 6, f. 1.

Hab.—Along with numerous specimens of *C. nigrescens*, marked as coming from Boston, Torquay, and Arran, one single specimen of this pretty species was sent to me by W. C. Williamson, Esq.

15. CYTHERE CONVEXA. Tab. XXI, fig. 3.

Shell rounded, very convex, and presenting very much the appearance of a small Cypræa, or Cowrie shell. The surface is covered with numerous small, white, raised dots or points, which are disposed in radiating rows round the circumference, and the whole shell is of a white colour, and translucid. The margin of the shell is somewhat waved.

Hab.—Torquay, in sand; W. C. Williamson, Esq. Tenby, in sand, T. R. Jones, Esq.

Genus 2—CYTHEREIS.

CYTHEREIS, *T. R. Jones*, Entomost. of Cretac. Format., 1849
CYTHERE, *Munster*, Jahrbuch für Mineralogie, 1830.
— *Cornuel*, Mém. Géol. Soc. France.
CYTHERINA, *Roemer*, Jahrbuch, &c., 1838.
— *Reuss*, Verstein. Böhm. Kreideform.
— *Williamson*, Transact. Manch. Lit. Soc.
CYPRIDINA, *Bosquet*, Mém. Soc. Roy. Liège, 1847.

Animal unknown. Carapace valves or shell of an almost regular oblong shape, the dorsal and ventral margins lying nearly parallel to each other. Surface of a very irregular appearance, being wrinkled, ridged, and beset with tubercles, and crenulated or strongly toothed on the margins.

1. CYTHEREIS WHITEII. Tab. XX, figs. 3, 3 *a*.*

Shell oblong, flat, thin, somewhat narrower at one end than at the other. Larger extremity rounded; the narrower extremity somewhat truncated and strongly toothed. The anterior margin and rounded extremity are crenulated throughout the whole of their length, and have placed above them a sort of shelf or pinched-up fold, which runs parallel with the margin, and which is strongly serrated. A sharp crest, which is crenulated, runs along the centre of the valve. The posterior margin is nearly straight and smooth.

This species is remarkably handsome, and approaches near the *Cypridina serrulata* of Bosquet (Entomost. de la Craie de Maestricht, t. iv, f. 2, *a*, *b*), but is distinguished from it by being shorter and broader, and by the margin being continued straight to the end, and not interrupted and toothed, as in that species.

Hab.—Torquay, in sand; W. C. Williamson, Esq. Tenby, in sand; T. Rupert Jones, Esq.

2. CYTHEREIS JONESII. Tab. XX, fig. 1.†

Shell thick, oblong oval, rather broader at one extremity; the narrower end flattened, with seven strong teeth projecting from the edge, the outer teeth on each side being the strongest; the broader extremity rounded and convex. The centre of the shell is plane and smooth, and round the whole circumference there is a raised border or narrow plate, which is perforated at frequent intervals by open loop-holes.

This species approaches the *Cytherina coronata* of Roemer (vide Jahrbuch, 1833, t. vi, f. 30) in structure, but differs totally in form, and in having the strong teeth at narrow extremity.

Hab.—Isle of Skye, in sand; W. C. Williamson, Esq.

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* Named after Adam White, Esq., of the British Museum, well known as the able describer of many new species of Crustacea.

† Named after T. Rupert Jones, Esq., author of the 'Entomostraca of the Cretaceous Formation,' whose attention in forwarding me specimens of Ostracoda for examination I thus gladly acknowledge.

3. Cythereis antiquata. Tab. XX, fig. 2.

Shell oblong, very thick, rough with granulations, and having two or three thick crests or ribs running along the centre of the valves. One extremity is flattened, and has four short, stout teeth springing from its edge; the other is more convex and rounded. The whole circumference is wrinkled, and the shell presents a very antiquated appearance.

Hab.—Isle of Skye, in sand; W. C. Williamson, Esq.

Family 2—CYPRIDINADÆ.

Character.—Eyes two, pedunculated. Antennæ, two pairs, both pediform. Feet two pairs; one pair always inclosed within the shell, and of a very peculiar structure. Abdomen terminated by a broad lamellar plate, armed with strong claws and hooked spines.

Genus CYPRIDINA.

Cypridina, *M. Edwards*, Lamarck, Hist. Nat. An. s. Vert., 2d edit., v, 178, note, 1838; Hist. Nat. Crust., iii, 409.
— *Baird*, Ann. and Mag. Nat. Hist., 2d series, i, 21.
— *Dana*, Conspect. Crust., 50.
Cyprella (*not* Cypridina), *Bosquet*, Entomost. de la Craie de Maestricht.
Asterope, *Philippi*, Ann. Mag. Nat. Hist. (fide *Dana* in literis.)

As there is but one genus, the character given above for the family will suffice for it also.

The genus Cypridina was founded by M. Edwards in 1838, in a note to the genus Cypris, in the fifth volume of Lamarck's 'Hist. Nat. An. s. Vertèb.,' and was afterwards more fully detailed in the third volume of his 'Hist. Nat. Crust.' The animal resembles a good deal in its general form and structure that of the Cypris, while the shell at first sight might easily be mistaken for one of that genus. It has, however, two eyes, distinct from each other; two pairs of antennæ, both pediform; one pair of natatory feet; and a peculiar organ, apparently for supporting the ova, similar in purpose to, but differing in structure from, the second pair of feet in the Cypris. Only one species has been described by M. Edwards, a native of the Indian Ocean; but in the 'Ann. and Mag. of Nat. Hist.' for December 1847, I described two additional, one of which is a native of the Atlantic Ocean, and the other an inhabitant of the Scottish seas.

Anatomy, &c.—The eyes are two in number, situated nearly in the middle of the body. They are each placed upon a lengthened conical peduncle, are of an ovoid shape, and are composed of about twenty crystallines.

The first pair of antennæ (t., XXII, f. *e*) is large, and consists of five articulations, the last of which is short, and terminated by several long filaments; the second pair (t. XXIII, f. *c*) is shorter, and is formed of the same number of joints, each furnished with several setæ.

The mandible is a flat plate, armed at its extremity with three or four sharp teeth. The first pair of jaws is composed of a large body with three or four appendages, like fingers, armed with stout cilia, and having attached to each a large branchial plate (t. XXIII, f. *g*) furnished with fifty finely plumose setæ. The second pair (t. XXIII, f. *d*) consists of an oval plate, divided into three articulations, and armed with numerous short setæ.

The natatory feet (t. XXII, f. *b*) are peculiarly-formed organs, having as the basilar joint a large fleshy body, which gives off from its upper edge a long, slender branch, composed of eight articulations, furnished with long plumose filaments, and a small appendage from its anterior margin, formed of two short articulations. The oviferous feet (t. XXII, f. *f*) are long and slender bodies, cylindrical, twisted, divided into very numerous short joints, and furnished near the upper third of their length with several sharp, stout, serrated spines.

The abdomen (t. XXII, f. *g*) is terminated by a large caudal plate, which is broad, and armed at its extremity and inferior edge with several stout serrated hooks or claws.

Very little is known of the habits and manners of these curious little creatures. The two species here described were dredged by Mr. M'Andrew from a considerable depth, and were preserved dry; and the species described by me in the 'Annals and Magazine of Natural History' as inhabiting the Atlantic Ocean, was brought on board by means of the towing-net by Mr. Adams. Nothing of their habits, therefore, could be observed by either of these gentlemen; neither does M. Edwards give us any information with regard to them.

Among the various interesting drawings of Crustacea, however, made by Mr. Adams, during the voyage of H.M.S. Samarang, there was one kindly placed in my hands by him, which appears to represent another species of this genus. It was brought on board by the towing-net in the Sooloo Sea. Mr. Adams describes it as very quick in its motions, darting about with great velocity, and constantly revolving. He observed it, as well as the above-mentioned species, to be highly luminous.

M. Godeheu de Riville, in his paper on the luminosity of the sea, published in 1760, in the third volume of the 'Mémoires pour les Savans Etrangers,' describes and figures a small Entomostracon, which I think must belong to the genus in question, and of whose luminous properties he gives a very interesting description. Sailing along the coast of Malabar, when in 8° 47′ north lat., and in 73° east long. of Paris, the sea was observed to be unusually and most brilliantly luminous. Having had his attention previously directed to this interesting phenomenon, Riville determined to ascertain the cause. The water all round the vessel, and to a considerable distance from it, was white as snow; and, in the wake of the ship, innumerable star-like bodies of a still brighter lustre sparkled on the surface of the agitated surf. He had some water drawn up from alongside, and he then observed numerous, bright, sparkling spots in the bucket in which it was contained. Pouring it out upon a piece of linen, numbers of small bodies still giving out light, were observed adhering to the surface of the cloth. They were alive, and resembled, he says, "those small insects called in France *puces d'eau.*" The body of the animal was contained in a little shell, which was transparent, and resembled in form an almond cleft on one side, and notched at the superior part. The animal, besides several organs, which he shortly describes, had, he remarks, "a large foot, armed with a toothed talon, resembling that of the *puce d'eau,* and destined for the same uses, being a kind of rudder, which enables the insect to move about with swiftness." Such appears as yet to be the whole amount of our knowledge with regard to the habits of this genus.

1. Cypridina Mac Andrei. Tab. XXII, fig. 1 *a-g*.

Cypridina Mac Andrei, *Baird,* Ann. and Mag. Nat. Hist., 2d series, i, 21, t. 6 b, f. 1-7, 1847.

The shell or covering is of an oval shape, the two extremities prolonged into sharp points; that of upper extremity curved and projecting forwards, and a little upwards, that of inferior extremity projecting a little backwards. The whole surface of the valves is dotted over with small points, and on their anterior edge, near the upper extremity, they are deeply notched. The eyes are ovoid-shaped, and areolar.

The first pair of antennæ (t. XXII, f. 1 *e*) is of considerable length, and consists of five articulations. The basilar joint is the longest and largest; the second is of nearly equal size, and armed on its external edge with five or six short setæ; the third is the shortest; the fourth is about twice the length of the preceding, and like it sends off two or three short setæ at the extremities; and the fifth, or terminal, has at its extremity six or seven long setæ, which are not plumose. The second pair of antennæ (t. XXII, f. 1 *c*; t. XXIII, f. 1 *c*) is about two thirds the size of the first pair, and is divided into four articulations. The first, or basilar joint, is stout, and of considerable size; the second is nearly equally large; the third is short, about half the size of preceding; and the fourth is more slender, but considerably larger than the third. The second is beset on both upper and lower edge with numerous stout setæ, and from the junction of the third and fourth there issues two or three long, slender filaments; while the last joint is terminated by several strong serrated spines.

The natatory foot (t. XXII, f. 1 *b*) is a remarkable organ. It is composed of eight articulations. The first, or basilar joint, is very large, fleshy, and of a rounded oval form. The second joint is very narrow, compared with the first, and about one third of the length; while the remaining six are short, the whole scarcely equalling the second in length. From the base of each of these seven articulations issues a long filament, whilst from the anterior margin of the basilar joint there springs an appendage, consisting of two nearly equal, slender joints, the latter terminating in two blunt, crooked claws.

The first pair of jaws consists each of a square-formed plate, furnished on the inferior edge with three or four finger-like appendages, each provided with several short, but stout setæ, and having attached to its upper margin a large triangular-shaped plate, armed with about fifty filaments of considerable length. The second pair (t. XXII, f. 1 *d, d*) is composed each of a short, stout body of three articulations. The first joint is rather broad; the second larger, and furnished on its lower edge with three rounded finger-like bodies, each of which sends off several short setæ, while the third is very short and conical, and sends off about eight stout, somewhat serrated spines from its extremity and lower margin.

The oviferous feet (t. XXII, f. 1 *f*) are organs of a very peculiar appearance and structure. They are long, cylindrical, slender, and of a twisted form. They are each divided into very numerous short articulations, and armed at the free extremity with about eight or ten short, sharp-pointed spines, which again are in their turn provided with several sharp setæ near their extremities. They are inserted into the body near the lower third, are first curved upwards and backwards, and then twisted round and downwards; they are always inclosed within the shell, and appear to supply the place of the second pair of feet of the Cyprides, and no doubt answer the same purpose as these do in them.

The abdomen (t. XXII, f. 1 *g*) is terminated by a broad, caudal plate, which is large, flattish, and armed with nine strong hooks and spines; the six external of which are powerful-looking talons, and are serrated on their under edge. The first is much the longest and strongest, and they gradually become shorter as they descend, the last three being much smaller than the others, not serrated on their edges, but terminated by a tuft of short setæ.

It is rather remarkable that none of the long filaments or setæ, with which the different organs are furnished, are plumose in this species.

Hab.—Dredged in seventy fathoms, between the islands of Lewis and Skye, R. M'Andrew, Esq.

2. Cypridina Brenda. Tab. XXIII, fig. 1 *a-g*.

The shell or covering is oval, rounded at both extremities, rather narrower at the anterior, where it is deeply notched in front, producing a kind of short beak. The colour is of a dull white, opaque; the valves are smooth and tumid.

The eye (t. XXIII, f. 1 *a*) is large and ovoid, with about twenty areolæ.

The first pair of antennæ (t. XXIII, f. 1 *e*) is divided into five articulations; the first being the largest, and the others gradually becoming shorter as they descend, the last sending off four long, plumose filaments. The second pair (t. XXIII, f. 1 *c*) is curved, and formed of five joints: the basilar being stout and rather short; the second, longer, arched on one side, and provided with three or four long, simple setæ; the third is the shortest of all, with a projection on its under edge, which gives off two stout, plumose setæ; the fourth, longer and narrower than the preceding, is armed on its outer edge with five simple setæ; and the fifth is very slender, and terminated by four short, simple spines.

The natatory feet (t. XXIII, f. 1 *b*) are large, and like those of preceding species, except that the long filaments are distinctly and beautifully plumose, and that there was apparently no appendage attached to the basilar joint. The first (f. 1 *g*) and second pairs (f. 1 *d*) of jaws are of the same structure as in *C. Mac Andrei.* The oviferous feet (f. 1 *f*) are stronger than in the preceding species, and are armed with a much greater number of spines, being not less than twenty-four. The caudal plate is exactly the same as described in *Mac Andrei.*

Hab.—Dredged in from eighty to ninety fathoms sand, twenty miles east of the Noss in the Shetland Isles, R. M'Andrew, Esq.

ORDER II—COPEPODA.*

CARCINOIDA (*pars*), *Latreille*, Cuv. Règne An., iv, 151.
COPEPODES, *M. Edwards*, Hist. Nat. Crust., iii, 411.
COPEPODA, *Baird*, Trans. Berw. Nat. Club, ii, 1845.
CROPHYROPODA *A*, *Burmeister*, Organiz. of Trilob. (Ray Soc. edit.), 34.
CRUSTACEA COPEPODA (CYCLOPACEA), *Dana*, Proc. Amer. Acad. Arts and Sciences, 1847.

Character.—Body divided into several very distinct rings. Envelope consisting of a buckler, inclosing head and thorax. Mouth possessed of foot-jaws. Feet five pairs in number, mostly adapted for swimming. Ovary external.

* From κωπη, oar; and πους, foot.

Family 1—CYCLOPIDÆ.

PSEUDOPODA (*pars*), *Leach*, Edin. Enc., vii, 384, 1814.
— *Latreille*, Gen. Crust. et Ins., i; Hist. Nat. Crust., iv, 356, (exclus. gen. Argulus).
MONOCULI (*pars*), *M. Edwards*, Hist. Nat. Crust., iii, 423, 1840.
CYCLOPIDÉES, *Leach*, Dict. des Scien. Nat., xiv, 524 (exclus. gen. Polyphemus), 1819.
— *Desmarest*, Cons. gén. sur Crust.
CYCLOPIDÆ, *Baird*, Trans. Berw. Nat. Club, ii, 1845.

Character.—Head not distinguishable from body, being consolidated with the first segment of thorax. Foot-jaws two pairs, generally small. Legs five pairs; the fifth pair rudimentary. One eye. Both antennæ, in male, furnished with the swollen hinge-joint.

Bibliographical History.—The first notice of any subject of this family that I am aware of, is to be found in a little work of Stephanus Blancardus, the 'Schou-burg der Rupsen, Wormen, Ma'den, &c.' published at Amsterdam in 1688. His notice of it is however very brief, and the figure which he has given is very bad; being barely sufficient to enable us to make out that it is the *Cyclops quadricornis* he means to represent.

Leeuwenhoek appears to have been the next to take particular notice of any individual belonging to the family. In his 'Epistolæ ad Societatem Regiam Anglicam,' &c. (Epistola 121, written in 1699) he gives numerous details of an insect which he found in fresh water, and whose habits he seems to have studied with considerable attention. He gives a figure of it also, which, though far from being correct, suffices to show us that his insect is likewise the *Cyclops quadricornis*. His observations upon it are very interesting, and he discovered, among other things worthy of note, the great difference there is between the young and the old animals, though he did not carry his observations so far as to trace the transformations which take place.

In Number 283 of the 'Philosophical Transactions' for January and February, 1703, the same author gives a description of a polype (the *Hydra viridis* of Müller) growing upon the lemna, or duck-weed, which calls forth another paper from an anonymous correspondent, in Number 288, for November and December, 1703, in which the writer mentions his having frequently observed the same polype growing upon insects, especially upon "two sorts, of the crustaceous kind." Of these two species of animals, which he states are monoculous he gives figures, sufficiently correct to show them to be the *Cyclops quadricornis* and *Diaptomus Castor*, the first being a tolerable figure, though the second is very indifferent. The same writer also takes notice of a third animal of the same family, which is much smaller, and like a shrimp, but which he could never figure, evidently the *Canthocamptus minutus*.

Baker, in his 'Microscope made Easy,' 1743, makes a few remarks upon the same animals, and copies the figures from the 'Philosophical Transactions;' and in his 'Employment for the Microscope,' 1764, he publishes a letter from a correspondent, who gives a variety of details with regard to the animal which Leeuwenhoek describes, finds great fault with his figure, but gives a much worse one himself!

De Geer, in his 'Mémoires pour servir à l'Histoire des Insectes,' vol. vii, published in 1778, is the next author, I believe, who has entered into any details relative to this family. He describes at considerable length, and figures with tolerable accuracy, the *Cyclops quadricornis*, and confirms many of Leeuwenhoek's statements respecting it, particularly the great difference between the young and the old animal.

Otho Fridericus Müller * is the next succeeding author who has particularly noticed the family. Previous to his time,[*] with the exception of detached notices, such as I have mentioned above, one species only of this family seems to have been noticed by authors, which, like all the other Entomostraca then known, was arranged and described under the general name Monoculus. He was the first, as I have already mentioned, to divide the different animals which figured under this name into distinct genera; and having discovered in the marshes and on the shores of Denmark and Norway, a variety of species, all agreeing in many characters with each other, he formed them into one distinct genus, and gave the name of Cyclops to it. He has given a number of interesting particulars of many of these little creatures, but has fallen into two or three mistakes concerning them, which will be pointed out hereafter.

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* Zoolog. Dan. Prodrom., 1776; Entomostraca, seu Insecta Testacea, &c., 1785.

Some time after Müller, Ramdohr, in 1805, published, in his little work on the Monoculi,[†] a very correct account of the anatomy, &c. of three species found in fresh water, accompanied with plates, which possess very considerable accuracy, and traces their whole transformation from the egg to the perfect animal.

Louis Jurine [‡] (père) some years afterwards published his excellent monograph, and in it has given us the fullest, most interesting, and most accurate information upon the fresh-water species belonging to the family, of any author who has written upon the subject. He declines the name of Cyclops, which Müller had given it, and prefers the old term Monoculus; but he has rectified the mistakes which that naturalist had fallen into, and completed, by a series of wonderfully careful experiments, the previous discoveries of Leeuwenhoek and De Geer. This he had done, without even alluding to the labours of Ramdohr, and indeed seems to be ignorant of his discoveries, though the work of Ramdohr preceded his by fifteen years.

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[*] "Unicum quidem ante annum 1769, quo in *Synopsi Monoculorum* quatuor novas Cyclopes fluviatiles publici juris feci, nempe Monoculus quadricornis Entomologis innotuit."—Entomost., 100.

[†] Beytrage zur Naturgeschichte einiger deutschen Monoculus-arten. 4to, Halle, 1805.

[‡] Histoire des Monocles qui se trouvent aux Environs de Genève, 1820.

Gunner,* Ström,† Tilesius,‡ Viviani,§ &c. had all noticed or described various species, previous to Jurine's time, and several new species have been described since; but, subsequently to his history, no work has been exclusively devoted to the Entomostraca.

Mr. Templeton, however, has added several new species belonging to this family, which he discovered within the tropics, and Koch has described a good many in Germany, while M. Milne Edwards has bestowed much pains in elucidating their systematic arrangement.

Lately Mr. Dana has added a great many species, discovered by him during the American voyage of exploration under Captain Wilkes, and has described them in the 'Proceedings of the American Academy of Arts and Sciences' for 1847 and 1849.

Anatomy and Physiology, &c.—The body of the animal, which is soft and gelatinous, is inclosed within a horny shell, which covers it like a buckler, but opens inferiorly to give issue to the antennæ, organs of the mouth, and feet. In general the thorax and abdomen are pretty easily to be distinguished from each other, and are composed of about ten segments, the thorax usually having four, and the abdomen six. In the upper or cephalo-thoracic segment, which is usually much the largest of all, we find the eye, the antennæ, mandibles, mouth, a pair of foot-jaws, and one pair of feet.

The eye is situate near the upper extremity of this first segment, and in the centre. It is tolerably large, and is single, and in some, as in the *Diaptomus Castor*, we can perceive the muscles which move it, of which there are several. The antennæ are four in number. The superior

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* Skrifter som udi det Kiobenhavnske Selskab., Deel x, 1765.

† Ibid., Deel ix, 1765.

‡ Mémoires de l'Acad. Impér. des Scien. de Pétersbourg, v.

§ Phosphorentia Maris, &c., 1805.

arise from the upper portion of the segment, on each side of the eye; they are always larger than the inferior pair, and are generally composed of numerous articulations, which are plentifully supplied with short setæ.

The male is distinguished by a peculiarity in the antennæ which at once marks the sex. Most frequently they are shorter and thicker than in the female, and either one (the right one as in *Diaptomus Castor*) or both (as in *Cyclops quadricornis*, &c.) have a swelling near the centre, or towards the extremity, followed by a moveable joint, which acts like a hinge, and which serves a very useful purpose in the act of copulation. The inferior antennæ, or antennules, are situate immediately beneath the preceding, and are composed of fewer articulations. Both of these organs are made use of by the animal to assist itself in progressive motion. Immediately below the antennules is situate the mouth, in which we find a labrum or lip, and the mandibles: these latter organs may be described as consisting of three parts, body, neck,* and palpiform branch, but differing from each other in several respects in the various genera. Beneath these, again, are situate the jaws, which are almost obsolete in this family.

Below the mandibles are situate the foot-jaws, which Jurine calls hands; a term which Müller had already applied to the same organs in one marine species he describes, the *Cyclops chelifer*.† These organs are always situate in the same place, but all differ from each other in so many respects that it will be necessary to describe them in the species of each genus separately. The use of these organs, according to Jurine, is to push constantly towards the mouth a current of water, carrying along with it the particles destined for the animal's food. Immediately beneath the foot-jaws are situate the first pair of feet. They are double, consisting of two stalks arising from a common base, each stalk consisting generally of from two to four articulations, more or less furnished with setæ,

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* Prolongation of Jurine.

† Entomost., p. 114.

but varying very much in the different genera. Attached to the next three segments of the thorax, and arising from the interstices between each, we find three other pairs of double feet, in general resembling each other exactly, and adapted solely for the purpose of swimming. The fifth pair is very small, nearly rudimentary. It is attached to the first segment of the abdomen, and is larger in the female than in the male. It differs somewhat in appearance in the different species, and as its use was supposed by Jurine to be, to give support to the oviducts which furnish the envelope of the external ovaries, has been called by him "les supports ou fulcra."

The female organ of generation or vulva is placed in the abdomen also, at the junction of the second segment with the third; this opening forms also the mouth of the *canalis deferens*, which communicates directly with the internal ovary, and gives passage to the eggs. In most of the species the male organs appear to be situate in the first segment of the abdomen, though in the *Cyclops quadricornis* we find them in the second. The external ovary, or bag of eggs, springs from where the second segment articulates with the third, and is attached to it by a very slender pedicle. The internal ovaries consist of an opaque mass of solid looking matter, composed of numerous round globules of a dark-brown colour, disposed round the alimentary canal, and occupying a considerable space of the interior of the body. This, as I have already stated, has a direct communication with the opening at the junction of the second with the third segment of the abdomen, the *canalis deferens* of Jurine; and it is through this canal that the eggs pass into the external ovary.

The alimentary canal is very perceptible, beginning behind at the place which I have mentioned as the situation of the lips, and terminating at the extremity of the abdomen where the tail commences. The tail consists of a bifid segment, which is generally short and terminates in two or more long setæ.

The species belonging to this family are to be found both in fresh water and in the sea. The fresh-water species abound in the muddiest, most stagnant pools, and in the clearest springs, and the ordinary water with which the inhabitants of London are supplied for domestic purposes often contains them in great numbers. The marine species are to be found frequently in immense quantities in small pools on the sea shore, within high-water mark, living among the sea-weeds and corallines, which so elegantly fringe the beautiful little wells and clear round pools which are hollowed out in the rocks on the coast, and are to be met with in equal profusion in the open ocean, where, by the curious luminous properties they possess, they assist in producing that beautiful phosphorescent appearance of the sea, which formerly puzzled naturalists to discover the cause of. It is amazing when we examine the pools of water in our fields or sea shores, to find such infinite myriads of little creatures sporting about in all the enjoyment of existence; and it is exceedingly curious and interesting to know the extraordinary fertility of such apparently insignificant creatures. Specimens of the *Cyclops quadricornis* are often found carrying thirty or forty eggs on each side;* and though the other species, which have only one external ovary, do not carry so many, still the number is very considerable. Jurine has with great fidelity watched the hatching and increase of the *Cyclops quadricornis* in particular, and has given a calculation which shows the amazing fertility of the species. He has seen one female isolated lay ten times successively, but in order to speak within bounds, he supposes her to lay eight times within three months, and each time only forty eggs. At the end of one year this female would have been the progenitor of 4,442,189,120 young!! The first mother lays 40 eggs, which at the end of three months, at eight layings during that time, would give 320 young. Out of this number he calculates 80 as males (there being in every laying a great proportion of females), the remaining 240 are females.

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* Leeuwenhoek says, that in the specimens which occurred to him of the quadricornis, he counted the eggs in the ovary and found them arranged three or four in breadth, and nine or ten in length.—Epist. ad Soc. Règ. Aug., p. 138.

The following table will show the prodigious extent of of their fecundity :*

	No. of layings.	Time employed for these eight layings.	TOTAL. Each laying supposed to be of 10 young.	Subtract for males.	Females remaining.
1st mother .	8	From 1st Jan. to end of March	320	80	240
1st family of females 240	8	From 1st April to end of June	76,800	19,200	57,600
2d family of females 57,600	8	From 1st July to end of Septem.	18,432,000	4,608,000	13,824,000
3d fam. of fem. 13,824,000	8	From 1st October to end of Dec.	4,423,680,000	1,105,920,000	3,317,760,000
			4,442,189,120	1,110,547,280	3,331,641,840

A single copulation suffices to fecundate the female for life. The male seems very ardent in his amours. By way of prelude, he seizes hold of the hinder feet of the female with his antennæ, which being furnished at its extremity with the hinge-joint already described, forms a fastening round her feet, which she cannot loosen by any exertion, and thus he is carried about with great rapidity for some time. The female, however, at length stops, wearied by her exertions, when the male seizes the favorable moment, and in the twinkling of an eye (as Jurine expresses it) makes a double copulation, one on each side. According to Müller, the male organs are situate in the swellings which we perceive in the antennæ of that sex, and which are characteristic of it. Carried away by the analogy of the Arachnidæ, and seeing the male take hold of the lower part of the female with his antennæ, he immediately conjectured that the organs resided in the swellings which mark the antennæ of the male, and were applied to the vulva, which he correctly enough states to be situate in the abdomen.* This mistake, however, Jurine has cleared up, having demonstrated the organs in both sexes, and watched the act of copulation itself. When the mother is about to lay, we may perceive the material of the eggs, which I have described above under the name of internal ovary, divide into two columns, one on each side, and pass through the canalis deferens, covered with a fine pellicle, which forms the sac in which the eggs are contained when extruded. This bag of eggs, or external ovary, remains suspended at the tail of the female for several days, varying from two to ten, according to temperature of weather, &c.† The eggs themselves, during their sojourn there, do not increase in size, but undergo various changes in colour, &c., and at the proper time the ovary opens, and the young ones are ushered forth into life, as unlike the parent as can well be imagined. I have already said that Leeuwenhoek has noticed this difference between the young and old, and upon first observing it, he appears to have been much surprised at the unexpected discovery. He repeated his experiment, therefore, of separating an insect, with the ova attached to the tail, and found the same result: "Ex hisce visis," he concludes, "certa mihi persuasi ea animalcula, quæ jam oculis meis observabantur, ex ovis illis nata esse."‡ He watched them for seven or eight days, and found them increased in size; but here, when just on the threshold of discovery, he seems to have stopped, and he makes no further mention of a continuation of his observations.

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* Jurine, Hist. des Monoc., &c., p. 32.

De Geer also noticed this curious fact, confirms the observations of Leeuwenhoek as far as they went, gives figures of the young at different stages of their growth; but after having watched them for about fifteen days, he likewise appears to have desisted from further inquiry.

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* Entomost., pp. 16, 17.

† Leeuwenhoek says they extrude their ova in the space of one day or night, and bring them to perfection in the space of three days.—Epist. ad Soc. Reg. Ang.

‡ Epist. ad Soc. Reg., p. 139.

Notwithstanding this, Müller could not persuade himself that such dissimilar creatures could be the same animal, and he has accordingly, without giving sufficient credit to these illustrious men, or watching the hatching and progress of the young himself, formed these imperfect creatures into two distinct genera, which he has called Nauplius and Amymone.* Ramdohr and Jurine, however, have both rectified this mistake, and fully corroborated the assertions of Leeuwenhoek and De Geer, by following out the transformations in all their extent.

The time occupied in this process varies much according to the season of the year and the temperature. This latter I have found produces an amazing difference in the duration of the period so occupied, and I have no doubt also, from my own experiments, that the process has been retarded or hastened, just as the vessel in which they have been kept has been placed in a light or dark situation. Jurine says, in the case of the *Cyclops quadricornis*, this process has always lasted twenty days; and in a series of very careful experiments which he made in February and March, he found it extend to twenty-eight days. For the first eight days they underwent little or no change; between the eighth and thirteenth, the body appeared a little more elongated; between the thirteenth and nineteenth, the line of demarcation between this increase of length and primitive size was traceable by a line of a brown colour, and the insect had acquired a third pair of feet; between the nineteenth and twenty-fifth, no great change took place, only the third pair of feet were more developed; between the twenty-fifth and twenty-eighth, the first moulting took place; and thirteen days afterwards they moulted a second time.

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* Entomost., pp. 39-48. It is stated by Latreille, and echoed by some other writers, that the Amymone of Müller is the young of the Cyclops, in its earliest state, when it has as yet only four legs, and that when it receives the additional pair it then becomes the Nauplius. This is not correct. The different species of the Amymone are the young of the *C. minutus* in different stages, and of one or two marine species; and never assume the form of the Nauplius. The Nauplius (at least the *Nauplius saltatorius*) is the young of the *Cyclops quadricornis*, which at its earliest stage resembles fig. 3 of plate 1 of Müller. The *Nauplius bracteatus* I have never seen, and do not know.

In a series of experiments which I undertook, upon the same species, in the end of June and beginning of July, when the thermometer was frequently above 80° during the day, I found the time occupied in the process in some instances very much shortened. In one brood, which were hatched on the 21st of June, I found some had completed their first moulting on the 1st of July, or on the eleventh day. In another brood, hatched on the 22d of June, I found the same result, several of the young having completed their first moulting on the 2d of July. On the 4th I could only see one that had not moulted; and next day, the 5th, this one had also undergone the change. The second moulting in many of them took place only a few days after the first. In another brood, hatched a little earlier in June, when the weather was not so hot, I found the changes took place as follows: When hatched, the insect appeared of an oval shape (t. XXIV, f. 7), having two thick antennæ, of three articulations each; two pairs of feet, bifid at extremity; in the upper pair, one division consisting of two and the other of only one articulation; in the lower, both divisions having only one articulation. Extremity of body furnished with two short setæ on each side. On the eighth day (t. XXIV, f. 8), the body was considerably elongated, and a well-defined line now showed the distinction between this increase and original size. Some traces of setæ also had appeared, where the third pair of feet afterwards spring; intestine very distinct. On the fifteenth day (t. XXIV, f. 9), the third pair of feet had become visible; the lower part of the body more elongated, the elongation marked by another line of demarcation. The setæ on the edges of the antennæ were now perceptible, and those of the feet longer and more numerous, whilst the second pair of feet had the upper division of two articulations. On the seventeenth day moulting had taken place (t. XXIV, f. 10); the body was divided into two segments, abdomen into three, the terminating one cleft at extremity, each cleft sending off a long seta; antennæ of about six articulations; the antennules had become distinctly visible, and the feet had assumed the appearance they afterwards bear. At each moulting the number of segments into which the body and abdomen are divided increase in number. The number of articulations and the length of antennæ increase, &c.; but it is not until after the third moulting that the animal is perfect (t. XXIV, f. 3), and capable of producing its species.

A question has been started, whether the Cyclopidæ should be considered oviparous or viviparous; and it appears to be one of some difficulty, as they would seem, from what I have stated, to be both. Geoffroy asserts that all the Monoculi are oviparous.* De Geer also says they are oviparous. "However," he immediately adds, "as the Monoculi never quit their eggs before the young ones are hatched, we may perhaps regard them as viviparous."† Jurine says it is difficult to decide. Viviparous young, he remarks, increase in size every day, and have constant need of a mother's care—if she die, all die; but as the young of the Cyclopidæ do *not* increase in size after passing from the internal ovary, and as, from numerous experiments which he details, they were found, after having passed into the external ovary, to be independent of the life of the mother, even if she were killed by spirits of wine, they must, he concludes, be considered oviparous.‡

The process of moulting, under which the little creature frequently succumbs, is both interesting and curious. The new shell or covering having grown under the old one, when the process of changing it commences, the insect fastens itself to the bottom or side of the vessel in which it is, or to any solid object near it, so as to give itself support; it then, by moving its limbs and shaking the valves of the shell, the new parts at the same time coming forward, loosens the old covering, and in a short time frees itself from the exuviæ altogether, leaving behind the sheaths of the limbs, hairs, plumes, and even the minute setulæ, that almost escape the power of the microscope itself from their fineness, such as the delicate plumose setæ which adorn the filaments of the tail. "How far beyond all idea this most subtle fineness!" says Müller, from whom I have taken this description; "for they are sheaths containing other smaller sheaths, which again include other organs smaller still."*

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* Hist. abrég. des Insectes, 654.

† Mém. pour serv. à l'Hist. des Ins., vii, 435.

‡ Hist. Nat. des Monoc., 17.

The number of times they moult during life is not known; but Jurine says, they ordinarily, though not always, moult before each time of laying eggs. They certainly do not always do so; and perhaps the frequency of their moulting may depend much upon the temperature, the season, &c.

Having the experiments of Spallanzani and others, upon the reproduction of mutilated members in various animals, in his eye, M. Jurine instituted a series of experiments upon the *Cyclops quadricornis*, to see how far this power existed in this family. In his first attempts he failed, the animals having died before they moulted, and without showing any evident change in the mutilated members. At length, however, he succeeded. He cut off about two thirds of an antenna in a female, which lived and moulted, reappearing after moulting, with beautiful, perfect, new antennæ, the old one of the cast shell not having shown the least indication of a change.†

Some authors have asserted that these insects possess a wonderful power of resisting drought, and that when, by reason of the summer heats, the marshes become dried up, the little creatures do not die, but as soon as the mud is again moistened by the rain, they recover entirely. Jurine doubted this, and commenced a course of observations to

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* Entomost., p. 9.

† Hist. des Monoc., p. 40.

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prove that they have not this faculty. He selected twelve of the *Cyclops quadricornis,* removed them out of the water, and allowed them to remain fifteen minutes dry; seven of them he found to be irrecoverably dead; the remaining five revived. Again, he selected twelve others, and allowed them to remain twenty minutes dry; eleven out of the twelve died. A third time he selected twelve, and after exposing them to the air in a dry state for twenty-five minutes, he found that all had perished.*

These experiments, notwithstanding, are not quite conclusive, for the mud in which they are enveloped, and in which they are very gradually dried, while in their native habitats, might retain a certain degree of moisture sufficient to prevent life being utterly extinguished; and I have accordingly found, upon examining ponds which had been filled again by the rain after remaining two months dry, numerous specimens of the *Cyclops quadricornis* in all stages of growth. Their power of resisting the action of cold, however, according to Müller, is much greater than their power of defying drought. In an experiment which he details, he says that he exposed some individuals of the *Cyclops quadricornis,* in a glass vessel, to a freezing air, and that when fully frozen, he continued the exposure for twenty-four hours. At the end of that time he placed the vessel containing their frozen bodies in a warm bath, watching the effect of this upon them frequently during the succeeding twenty-four hours, but without seeing any motion. Next morning, however, upon looking into the vessel, he observed, not without wonder, the insects alive, and swimming about as before congelation, the females with their bags of eggs adhering to them as usual;† but although they did not all recover, the greater part were restored to life.

In some other similar experiments upon these little creatures, throwing them into a state of asphyxia by means of spirits of wine, and then restoring them to life again, Jurine found that the first part of the body to show irritability and a return of motion was not the heart, as perhaps might be expected, but the alimentary canal; the heart seems to be the next, then the antennæ, and last the feet.

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* P. 39.

† Entomost., pp. 5, 6.

De Geer asserts, that the Cyclopidæ, along with the other Monoculi, are nourished by animalcules. Leeuwenhoek, in addition to this, asserts, that when deprived of other food, they devour their own young. De Geer also says that he has seen this frequently to be the case. Jurine has repeatedly witnessed the same; but says, in vindication of his beloved insects, that it would appear from what he has noticed, that they do not do so *from taste*, but that the helpless young cannot resist the action of the whirlpool the mother causes around her, and are carried unconsciously into her mouth.* I have also observed the sudden disappearance of the young when no other animals were in the vessel but their mother, and who, it is most probable, must have devoured them; and from what I have noticed, I think the variety *albidus* of the species *quadricornis*, is the one which possesses this carnivorous propensity in the greatest degree. Müller, however, maintains that the *Cyclops quadricornis*, as well as others of the Entomostraca, live upon vegetable food; and I have mentioned above (p. 5) the experiment he instituted upon the subject.† But notwithstanding this, it is evident he labours under a mistake; and there is every reason to presume, that their being carnivorous serves a most useful purpose in the economy of nature. The adults, in their turn, fall victims to and are devoured by other insects, the chief of which are the Hydrachnæ, Hydræ, and larvæ of aquatic insects, which destroy them in such vast numbers, as in some measure to counterbalance the most extraordinary fertility which they possess.

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* Vide the observations of M. Joly upon the *Artemia salina*, supra, p. 59.

† Geoffroy also says that all the Monoculi live upon vegetable matter alone.—Hist. abrég. des Ins., ii, 654.

This family contains the following genera:—

1. CYCLOPS.—Foot-jaws large and strong-branched; antennules simple; ovaries double.

2. CANTHOCAMPTUS.—Foot-jaws small, simple; antennules simple; ovary single.

3. ARPACTICUS.—Foot-jaws forming strong cheliform hands; antennules simple; ovary single.

4. ALTEUTHA.—Foot-jaws small, simple; body flat; two strong falciform appendages from fifth segment of body.

Genus 1—CYCLOPS.*

CYCLOPS, *Müller, Latreille, Desmarest, M. Edwards, Koch,* &c.
MONOCULUS, *Linnæus, Fabricius, Jurine,* &c. &c.

Character.—Foot-jaws large and strong, branched. Antennules simple. Ovaries double. Both antennæ in the male possessed of the swelling and hinge-joint.

1. CYCLOPS QUADRICORNIS. Tab. XXIV, figs. 1-10.

MONOCULUS QUADRICORNIS, *Linnæus,* Faun. Suec., No. 2049, 1746; Syst. Nat., edit. 10th, i, 635, No. 6; edit. 12th, 1058, No. 6.
— *Gmelin,* Linn. Syst. Nat., edit. 13th, i, 2996, No. 6.
— *Scopoli,* Entomologia Carniolica, 413, No. 1139.
— *Fabricius,* Syst. Entomol., 295.
— *Jurine,* Hist. Nat. Monoc., 1-49, t. 1, 2, 3.
— *Sulzer,* Insecten, t. 30, f. 9 *b.*
— *Donovan,* Hist. of Brit. Ins., i, 7, t. 2, f. 1-5.
— *Blumenbach,* Handb. der Naturg., 399, No. 4.
— *Manuel,* Enc. méth., vii, 718.
— *Barbut,* Gen. Insect. Linn., tab. xx, gen. xi.
— *Shaw,* Nat. Miscell., xxi, t. 904.
MONOCULUS APUS, *Poda,* Insect. Mus. Græcens., 125, t. 1, f. 11, 12, 1761.
LE MONOCLE À QUEUE FOURCHUE, *Geoffroy,* Hist. abrég. Ins. Par., ii, 656, No. 3, t. 21, f. 5, 1761.

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* Κυκλωψ—from κυκλος, orbis; and ωψ, oculus.

Le Monocle à quatre cornes, *De Geer*, Mém. serv. à l'Hist. Ins., vii, 483, t. 29, f. 11, 12 (adult); t. 30, f. 5-9 (egg and young).
Cyclops quadricornis, *Müller*, Zool. Dan. Prod., 2416, 1776; Entomostraca, 109, t. 18, f. 1-4.
— *Ramdohr*, Beyt. zur Naturg. einig. Deutsch. Monoc. art., 1-6, t. 1, f. 1-10, t. 2, f. 1-3.
— *Latreille*, Cuv. Règne Anim., iv, 158; Hist. Nat. gén. et part. Crust., iv, 262; Genera Crust. et Ins., i, 19.
— *Bosc*, Mém. d'Hist. Nat. Crust., ii, 258.
— *Lamarck*, Hist. An. s. Vert., v, 188.
— *Baird*, Mag. Zool. and Bot., i, 321, t. 8, f. 1-14; Trans. Berw. Nat. Club, ii, 154.
— *Leach*, Edin. Encyc., vii, 383, art. Crustac.
— *Koch*, Deutsch. Crustac., ii, t. 21.
Cyclops Geoffroyi, *Samouelle*, British Insects, 81.
Cyclops vulgaris, *Desmarest*, Cons. gén. Crust., 362, t. 53, f. 1-4, 1825.
— *M. Edwards*, Hist. Nat. Crust., iii, 425, t. 37, f. 19.
— *Leach*, Dict. Sc. Nat., xiv, 539.
— *Baird*, Trans. Berw. Nat. Club, i, 97, t. 2, f. 3, 21 (the young.)
— *Garner*, Nat. Hist. of Staffordshire.
Pediculus aquaticus, *Baker*, Employm. for Micros., 383, t. 15, f. 1-4.
Satyr, *Baker*, l. c., t. 12, f. 23-26 (the young).
Nauplius saltatorius, *Müller*, Zool. Dan. Prod., No. 2378; Entomost., 40, t. 1, f. 3-7 (the young.)
Four-horned Cyclops, or small Water-flea, *Pritchard*, Microscop. Cab., 91, t. 9, f. 1, 2.
De Geer, Kongl. Svensk. Vetensk. Acad. Hand., viii, f. 2, 3.
Eichhorn, Beyt. zur Naturg. der kleinst. Wasser., 54, t. 5, f. *m*, *n*.
Roesel, Der Insecten Belust., iii. 606, t. 98, f. 1, 2, 4.*
Baker, Microscope made Easy, 93, t. 9, f. 1, 2.
Leeuwenhoek, Epist. ad Soc. Reg. Angl., 142, f. 1, 2, 3.
Blancardus, Schou-burg der Rups. Worm. Ma'den., 151, t. 13, f. B.
Joblot, Observat. d'Hist. Nat., t. 14, f. *c*.
Der Naturforscher, Stuck v, 247.
Neue Mannigfaltig., i, 640, f. 3.
Philos. Trans. No. 288, f. 5.

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* The figure of the Cyclops is given in this plate by Roesel, chiefly as being the resting-place for a species of polype which he describes, and with which, as often happens, the body of the little creature is almost completely covered.

The thorax and abdomen are very distinct from each other; the former being twice the size of the latter. The thorax is composed of four segments, the abdomen of six; but, in the female, the second and third are so united as to appear only one. The last segment terminates in two lobes. The first segment of the thorax, to which the head is immoveably fixed, and with which it is perfectly consolidated, is much larger than any of the others, being equal in size to all the other three; the second and third are nearly equal in size, and the fourth is the smallest.

The antennæ consist of numerous articulations, amounting to twenty-six; each articulation throws forward a seta, sometimes two. In the male (t. XXIV, f. 1) they are shorter than in the female, and they each possess a peculiar swelling about the middle of their length, followed by a sudden contraction, the first articulation of which forms a hinge-joint. If we throw the animal into a state of semi-asphyxia by placing it in a mixture of spirits of wine and water, we perceive these antennæ turn round in a contrary direction to what they ordinarily do when in their native element, and curving their extremities at this hinge-joint, they bend back the part beyond it upon the swollen portion. The antennules are divided into four articulations (t. XXIV, f. *a*), each furnished with several setæ; the terminating one having six of unequal length.

The mandibles (t. XXIV, f. *b*) are composed of three parts, body, neck, and palpiform branch.

The body is of an ovoid shape, convex on the upper, and concave on the under surface, in which concavity is lodged its motor muscle. The neck is a sort of petiole, turned upon itself, and dilated at its extremity, in which are implanted six tolerably strong teeth. The palpiform branch consists of one ring, and two long filaments.

A little behind the mandibles we see the anterior, or first pair of foot-jaws (t. XXIV, f. *c*), which are strong organs, each composed of a pretty large body, convex externally, and concave internally, giving origin to two processes, the largest of which is terminated by two or three strong, horny teeth. The posterior or second pair of foot-jaws (t. XXIV, f. *d*, *e*) are divided to the base into two parts; the internal (f. *e*), which Jurine (who calls these organs hands) compares to a thumb, is much smaller than the other, and is formed of three articulations; the first of which, much the longest, has on the inner edge several rather strong, plumose spines, or setæ; the second, very short, sends off one long spine; while the third, which is the smallest, is terminated by three spines. The external division (f. *d*) is also composed of three articulations, at the base of the first of which is attached the thumb; this joint is much the longest, and has on internal side two tubercles, from each of which issues a plumose spine, while a third, longer, springs from near its articulation with the second joint. This second joint is in form of a strong claw, and has attached to its upper edge the third joint, in form of a claw also, but much smaller than preceding. These claws are called fingers by Jurine.

The feet are ten in number, or five pairs. Four pairs spring from the four thoracic rings, and are all alike. Each foot is double, or composed of two branches, arising from a common base (t. XXIV, f. *f*); each branch consists of three articulations, and each articulation is furnished with plumose setæ, the terminating one having six or seven. The first segment of the abdomen is very small, and has the fifth pair of feet (t. XXIV, f. *g*) attached to it. These are quite rudimentary, and differ in the two sexes. In the female it consists of a short body, of two segments; the first broader, and giving off from its outer edge a sharp spine; the second narrower, giving off from its internal edge a short spine, and terminating inferiorly in a long, slightly-curved spine. These organs are what Jurine describes as the "fulcra, or supports." In the male they consist of an oval body, composed of three segments, diminishing each in size as they descend, and terminating in a sharp, prolonged point. These were considered the male organs by Jurine. The second is the largest.

In the female, as I have already mentioned, the second and third are united; and running across its centre, we may see a small canal which opens on each side where the external ovary is given off, and in all probability furnishes the envelope which contains the ova. This canal has a direct communication with the internal ovary.

The tail consists of two long lobes, making it appear bifurcated, each lobe giving origin to four plumose setæ, the two intermediate of which are much the longest, and have near the upper extremity a small joint, which adds much to the suppleness of these fine organs.

The internal ovaries are tolerably large, and divaricate. The external ovaries, of the same colour as the adult, contain in old females thirty or forty eggs on each side. The length of this species is from $\frac{7}{12}$th to $\frac{9}{12}$th of an inch.

The *Cyclops quadricornis* differs very much according to age, locality, &c.* Jurine enumerates seven distinct varieties in the neighbourhood of Geneva. I have met with several in the vicinity of London, which I have been sometimes almost tempted to consider as distinct species.

Var. *a, elongatus.*—Ramdohr's figure corresponds exactly to this variety. It is of a dull gray colour, and is of an elongate and narrow form. The thorax, abdomen, and caudal segments, as well as the long filaments attached to the tail, all partake of the same general elongate figure. The antennæ, however, are a little shorter than in the other varieties. The segments of the thorax and abdomen are more distinct (t. XXIV, f. 3.)

CYCLOPS QUADRICORNIS, *Ramdohr,* Beitrage, t. 1, f. 1.
— *Koch,* Deutsch. Crust., h. xxi, t. 11.
CYCLOPS AGILIS, *Koch,* l. c., h. xxi, t. 3.

Var. *b.*—Jurine's figures of the vars. *rubens, albidus,* and *viridis* agree with this variety. It may be considered the type of the species. The thorax is more or less com-

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* "Variat colore albida, fulvescente, viridi et rubro."—Müll., l. c., p. 112.

pletely oval in form, and more rounded than in preceding varieties. The caudal segments and filaments are rather shorter and thicker, and the antennæ longer. It varies in colour according to locality, &c. Sometimes it is of a red colour, sometimes of a dull white; and at others of a green, more or less deep. The external ovaries are carried diverging out from the abdomen more or less at a right angle with it (t. XXIV, f. 4.)

Cyclops quadricornis, *vars.* rubens, albidus, *and* viridis, *Jurine,* Hist. Monoc., t. 1, f. 1-11; t. 2, f. 1-9; t. 2, f. 10, 11; t. 3, f. 1-3.
Cyclops pictus, *Koch,* l. c., h. xxi, t. 1.
Cyclops pulchellus, *Koch,* l. c., h. xxi, t. 2.
Cyclops vulgaris, *Koch,* l. c., h. xxi, t. 4.
Cyclops obsoletus, *Koch,* l. c., h. xxi, t. 5.
Cyclops bistriatus, *Koch,* l. c., h. xxi, t. 7.
Cyclops lucidulus, *Koch,* l. c., h. xxi, t. 10.

Var. *c.*—The figures given by Jurine of his varieties *fuscus* and *prasinus* agree with this variety. It differs from the last, chiefly in its carrying the external ovaries close upon and covering part of the abdomen. They do not appear ever to divaricate, either when the animal is at rest, or swimming. The inner edge of the caudal segments are beset with short, stout setæ; the antennæ are somewhat longer, and the last two joints of the antennules are considerably longer than in either of the two preceding varieties (t. XXIV, f. 5.)

Cyclops quadricornis, *vars.* fuscus *and* prasinus, *Jurine,* Hist. Monoc., t. iii, f. 5.
Cyclops phaleratus, *Koch,* Deutsch. Crust., h. xxi, t. 9.

Hab.—In ponds and ditches; common everywhere, almost all the year round.

Genus 2—CANTHOCAMPTUS.[*]

MONOCULUS, *Linnæus, Fabricius, Jurine,* &c.
CYCLOPS, *Müller, Ramdohr, Latreille, Desmarest,* &c.
CYCLOPSINA (*pars*), *M. Edwards.*
CANTHOCAMPUS, *Westwood,* Partington's Cyclop. Nat. Hist. art. Cyclops; The Entomologist's Text-Book, 115.
CANTHOCARPUS (*wrongly quoted*), *Baird,* Trans. Berw. Nat. Club, i, 97, and ii, 154; Mag. Zool. and Bot., i, 326.
HARPACTICUS (*pars*), *Dana,* Proc. Amer. Acad. Arts and Sc., 1847.
NAUPLIUS, *Philippi,* Ann. Mag. Nat. Hist., 1840; Wiegm. Archiv, 1843.

Character.—Foot-jaws small, simple. Antennules simple. Ovary single.[†]

1. CANTHOCAMPTUS MINUTUS. Tab. XXV, figs. 4-8; XXX, fig. 3.

CYCLOPS MINUTUS, *Müller,* Zool. Dan. Prod., No. 2409, 1776; Entomostraca, 101, t. 17, f. 1-7.
— *Ramdohr,* Beyt. zur Naturg., 10-13, t. 3, f. 1-9.
— *Latreille,* Hist. Nat. Crust., iv, 265.
— *Bosc,* Mém. Hist. Nat. Crust., ii, 257.
— *Lamarck,* Hist. An. s. Vert., v, 189.

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[*] From ακανθα, a spine; and καμπτος, flexible.

[†] M. Edwards includes the *Cyclops minutus* of Müller in his genus Cyclopsina. The antennules, however, are not branched (biramées) as they are in *Cyclops Castor*, which is the character upon which the genus Cyclopsina is founded; and therefore it must form a separate genus. The name *Canthocamptus* was proposed for it by Mr. Westwood, some years ago, from the flexible, horny appendage attached to the abdomen of the female. In Partington's Cyclopædia, art. Cyclops, and in the 'Entomologist's Text-Book,' this genus is indicated by Mr. Westwood, but misprinted *Canthocampus;* and it was farther misnamed by myself (quoting it from memory) in the 'Trans. Berw. Nat. Club,' i, *Canthocarpus;* reproduced again in the 'Mag. Zool. and Botany,' and in the second vol. of the 'Berw. Club Trans.' Philippi, in the Archiv, of Wiegmann and Erichsen for 1843, confirms my observations upon the structure of the antennules, and the propriety of separating the species from the genus *Cyclopsina* of Edwards. He forms of it, and some other species allied to it, the genus *Nauplius*. As that name was used by Müller for the young of the genus Cyclops, and as the genus *Canthocamptus* was shortly characterised by Mr. Westwood in the work quoted above as early as 1836, I have given the preference to Mr. Westwood's appellation, as having the priority in date. Philippi, moreover, includes the genus *Harpacticus* in his *Nauplius*.

CYCLOPS MINUTUS, *Baird,* Trans. Berw. Nat. Club, i, 97, t. 2, f. 1, 19, 20, and ii, 154; Mag. Zool. and Bot., i, 326, t. 9, f. 1-14.
MONOCULUS MINUTUS, *Gmelin,* Linn. Syst. Nat., edit. 13th, i, 2997, No. 11.
— *Fabricius,* Ent. Syst., ii, 499, No. 45.
— *Manuel,* Encyc. méth., vii, 719, t. 267, f. 2-6.
MONOCULUS STAPHYLINUS, *Jurine,* Hist. Nat. Monoc., 74-84, t. 7, f. 1-19, 1820.
CYCLOPS STAPHYLINUS, *Desmarest,* Cons. gén. Crust., 363, t. 53, f. 6.
— *Baird,* Trans. Berw. Nat. Club, i. 97, t. 2, f. 1 (adult); t. 2, f. 19, 20 (young).
SMALL CYCLOPS *or* VAULTER, *Pritchard,* Microscop. Cab., t. 9, f. 5.
Eichhorn, Beyt. zur Naturg., 53, t. 5, f. K, L (adult); t. 3, f. *p* (young).
Philos. Trans., No. 288.
Naturforscher, Stuck vii, 101.
AMYMONE SATYRA *and* BACCHA, &c., *Müller,* Entomost., 42, t. 2 (young).
DER SATYR, *Kohlers,* Naturforscher, x, 103, t. 2, f. 10 (young).
— *Pritchard,* Micros. Cab., t. 8, f. 2.
CYCLOPSINA STAPHYLINUS, *M. Edwards,* Hist. Nat. Crust., iii, 428.
CANTHOCARPUS STAPHYLINUS, *Baird,* Trans. Berw. Nat. Club, ii, 154, 1843.
NAUPLIUS MINUTUS, *Philippi,* Wiegm. and Erichs. Archiv, 1843, p. 69.
DORIS MINUTA, *Koch,* Deutsch. Crust., h. xxxv, t. 3, 1841.

The thorax and abdomen are not distinctly separated from each other. They are composed of ten segments, which gradually diminish in size as they descend. The first consolidated with the head, is the largest, and the last one terminates in two short lobes, from which issue two long filaments, slightly serrated on their edges. At the junction of the fifth with the fourth articulation, the body is very moveable, and the animal frequently turns up the posterior extremity upon the anterior, in the manner of the kind of beetle called Staphylinus. Jurine has taken the trivial name of *staphylinus* from this circumstance, objecting to the name of *minutus,* by which Müller originally designated it, as, he says, we may possibly find still smaller species. I have, however, retained the name which Müller bestowed, as he was the first author who gave any detailed description of it. The males (t. XXV, f. 4) are smaller than the females.

The antennæ are very short, compared with those of the two preceding genera. In the female (f. 5 *a*) they are composed of nine articulations; in the male (f. 4 *a*) of only seven. Between the fourth and fifth articulations in both sexes, we see a small lateral ring of one short joint, and two or three setæ.

In the male, both antennæ have the swelling and hinge-joint, the swelling existing chiefly about the fifth articulation; all the first five, however, being of greater size than the corresponding ones in the female. The hinge-joint is situated near the extremity.

The antennules are simple (t. XXV, f. 5 *b*), and composed of two articulations. Upon the first is placed a small shoot, terminated by four setæ, while the second is furnished with seven short spines on its upper edge, and terminated by four larger ones.

Jurine represents the antennules as of six articulations, and his figure of these organs differs entirely from mine, which after frequent and repeated examinations never varied in their appearance in the least.

The mandibles (f. 5 *c*) in figure resemble very much those organs in the *Cyclops quadricornis;* the palpiform branch springing from the centre, and consisting of three articulations, terminated by several setæ.

The anterior or first pair of foot-jaws (f. 5 *e*) are composed each of a pretty large, oval body, dividing at the extremity into four short digitations, of equal length, each furnished with three setæ. The posterior or second pair of foot-jaws (f. 5 *d*) are of very simple organization. They are formed of three articulations, the last of which appears to be a very fine hook, forming, with the other two, an angle always directed forwards towards the mouth. These hooks appear to stop all molecules of food in their passage, and, by their constant motion, carry them to the mandibles.

The feet are five pairs in number, and are much longer in proportion than in the preceding genus, and differ in some respects from each other. The first pair (f. 5 *f*) has both stalks divided into three articulations, the external having all three of nearly an equal length, whilst the internal has the first articulation nearly as long as all the three of the external put together, but the last two short, and inclined outwards. The three succeeding pairs (f. 5 *g*, *h*) have the internal stalk shorter than the external, both consisting of three joints, though Jurine says the external has five. The fourth pair are the longest of all. The fifth pair (f. 5 *i*) are small, and rudimentary. They are situated under the fifth segment, and consist each of a flat body, from each side of which issues an appendage furnished with several hairs, the external being the longer, and giving off a number of setæ also from its external edge. In the male they have been considered as the organs of generation.

At the base of the sixth ring in the female are the openings of the canalis deferens, and under the sixth and seventh segments the adults of the same sex carry a very singular, horny-looking, club-shaped organ, which is fastened to the body by a narrow, elongated stalk. It is somewhat curved, and directed backwards; its colour being almost always more or less of a red hue. This organ is not found in the young female, nor till after she has several times laid eggs. Its hardness is greater than that of the shell or carapace of the animal. Jurine has seen two in one female, one red, the other black. Its use is unknown.

M. Siebold has conjectured its use to be the same as that of the elongated tubes occasionally seen in the females of Diaptomus (see the description of that genus); and asserts that he has seen these bodies suspended over the genital region of the female, and still inclosed in the deferent canals of certain males, which by their antennæ were attached to the tail of the female. He never saw the male, however, fasten this body to the female.

Jurine says that this body is never seen in the female till *after* she has several times laid eggs. In my own experience, I have never seen more than one body attached to a female, and have never seen an adult without it, as the female has it constantly attached, though the young in the ova are ready to be hatched. It is so hard and horny too, and differs so much in texture and appearance from the spermatic tubes found in Diaptomus, being too solid to contain any soft matter, or to form a hollow tube, that I am much inclined to doubt the accuracy of Siebold's conjecture, and to believe that the true use of these organs is still unknown.

In copulation, the male of this species lays hold of the terminating segment of the abdomen of the female, just above the commencement of the long filaments which issue from it.

Hab.—Ponds and ditches of fresh water, all the year round; common.

2. CANTHOCAMPTUS STROMII. Tab. XXVII, fig. 3, 3 *a*.

CYCLOPS STROMII, *Baird*, Mag. Zool. and Bot., i, 330, t. 9, f. 23-25, 1837.
CYCLOPS BREVICORNIS, *Baird*, Trans. Berw. Nat. Club, i, 97, 1835.
CANTHOCARPUS STROMII, *Baird*, Trans. Berw. Nat. Club, ii, 154, 1845.
NAUPLIUS STROMII, *Philippi*, Wiegm. and Erichs. Archiv, 1843, p. 69.

The thorax and abdomen consist of ten segments, gradually tapering to the extremity, without any decided difference between them. The first segment, consolidated with the head, is the largest, and is furnished with a conical beak; the last segment terminates in two lobes, which give issue to two setæ. These are much shorter than those of the preceding species, being scarcely half the length of the body.

The antennæ are composed of eight short articulations, and at the junction of the fifth with the sixth they have a lateral joint. In the male, the swelling and hinge-joint are as in the preceding species. Each of the articulations of the antennæ throws forward one or two short setæ. The antennules are formed of two articulations, the second being terminated by about four somewhat long filaments. The mandibles were not seen. The posterior foot-jaws consist, as in the preceding species, of two articulations, and a tolerably strong hook, which points upwards.

The first pair of feet (t. XXVII, f. 3 *a*) has the external or superior stalk much smaller and shorter than the other, and is divided into three joints, the last of which is terminated by three rather strong setæ, or small hooks. The internal or inferior stalk is much the longer of the two, and is composed of two articulations, the first being very long in proportion to the second, which is exceedingly short, and terminated by a curved hook. The three succeeding pairs of feet are precisely similar to those of *C. minutus.* The fifth pair is rather larger than in preceding species, and is formed of a broad, flat body, which is rounded at one side, and furnished with several rather long and finely-serrated setæ; the opposite side giving off an appendage, provided likewise with setæ serrated on their edges.

When I first noticed this species, I considered it as the *Cyclops brevicornis* of Müller, who professes to take the species from Ström, in the 'Acta Hafniæ,'[*] and who, among other characters, describes it as "setis caudæ *brevissimis.*" Upon referring afterwards, however, to Ström's paper, and finding his description of it as "setis caudæ *longissimis,*" I gave it the name of *Cyclops Stromii*,[†] and having since that seen the figure he gives of the species he describes, I have no doubt of this being quite distinct.

Hab.—Sea-shore at Cockburnspath, Berwick, &c., amongst corallines and seaweeds, 1835. Dover, North Foreland, September 1849.

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[*] Vol. ix, p. 590.

[†] Mag. Zool. and Botany, i, 330.

3. Canthocamptus furcatus. Tab. XXV, figs. 1, 2; Tab. XXX, figs. 4, 5, 6.

Cyclops furcatus, *Baird*, Mag. Zool. and Bot., i, 330, t. 9, f. 26-28, 1837.
Cyclopsina furcatus, *M. Edwards*, Hist. Nat. Crust., iii, 429.
Canthocarpus furcatus, *Baird*, Trans. Berw. Nat. Club, ii, 154, 1845.
Nauplius furcatus, *Philippi*, Wiegm. and Erichs. Archiv, 1843, p. 69.

The thorax and abdomen are more distinctly separate from each other than the two preceding species, especially when viewed in a prone position. They are composed of ten segments, the first being the largest; the last terminating in two short lobes, from which issue two long setæ, more than half the length of the body, and two others, about half the length of the former. The first segment, with which the head is consolidated, is furnished with a short beak. The eye is of a bright ruby colour.

The antennæ consist of seven or eight articulations, and at the fourth joint are very distinctly forked. The upper division is not articulated, and is longer than the lower limb, which is divided into three or four joints, each of which throws upwards and forwards a tuft of short setæ. The antennules are formed of two articulations, the latter terminating in three or four rather long setæ. The mandibles were not seen. The posterior foot-jaws consist of two segments, the latter terminating in a curved hook, pointing upwards, as in *C. minutus*.

The first pair of feet (f. 2 *a*) has the superior or external stalk the longer of the two. It is composed of two joints, the first of which is short, and the second longer, having a strong tooth or process on its inferior edge, and terminating in three or four short, curved setæ or hooks. The inferior or internal stalk has three articulations; the first short and thick, the second longer and broad, and the third short and terminated by two tolerably long and straight setæ and five or six curved ones, each gradually becoming shorter than the others. The three succeeding pairs of legs resemble those of the two preceding species. The fifth pair (t. XXX, f. 5 *b*) has an appendage in the form of a long, slender, slightly-curved stalk, toothed or serrated on the upper edge, and terminating in three or four hairs. The external ovary (t. XXX, f. 4 *a*) is single, large, oval-shaped, and generally lying across the abdomen, in consequence perhaps of which the animal generally swims prone or supine, seldom swimming on its lateral surface, as the other species do. I have met with but few specimens of this species, all of which were females; and in two or three of these there was attached to the dorsal surface of the fourth segment of the body a substance very much resembling a polype, consisting of a pedicle and three branches, each branch terminated by four short fingers.

Hab.—Berwick Bay, 1835; not common. Dover, North Foreland, September 1849; rare. Poole, Sept. 1844, Henry Hyde Salter, Esq.*

4. CANTHOCAMPTUS MINUTICORNIS. Tab. XXV, fig. 3.

CYCLOPS MINUTICORNIS, *Müller*, Entomost., 117, t. 19, f. 14, 15, 1781.
— *Latreille*, Hist. Nat. Crust., iv, 267.
— *Bosc*, Man. Hist. Nat. Crust., ii, 267.
— *Baird*, Trans. Berw. Nat. Club, i, 97.
MONOCULUS MINUTICORNIS, *Manuel*, Enc. méth., vii, 720, t. 264, f. 21, 22.
— *Gmelin*, Linn. Syst. Nat., edit. 13th, i, 2998, No. 17.
CYCLOPS INERMIS, *Tilesius*, Mém. de l'Acad. de St. Pétersb., v. t. 8, f. 9.
CANTHOCARPUS MINUTICORNIS, *Baird*, Trans. Berw. Nat. Club, ii, 154.

The thorax is composed of four segments, each terminating at the back in a sharp spine. The first segment, comprising, like the other species, the head, is the largest, and is strongly marked with a large black spot, covering half of it, and very discernible to the naked eye.

The abdomen consists of five segments, the terminating one being bilobed, and furnished with a stout seta of about half the length of the animal. The antennæ are divided into eight very short articulations, having between the fourth and fifth a very small lateral joint, as in most of the other species. Each articulation sends off one or more setæ. The antennules are similar to these organs in the other species, as are also the posterior foot-jaws, which consist of two rounded joints, terminated by a slightly-curved hook.

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* The figures in tab. XXX, of this pretty little species, are from sketches made by Mr. Salter, at Poole, in September 1844, for which, with some interesting notes, I am indebted to the courtesy of Professor T. Bell, whose kindness, during the time I have been preparing this monograph, I feel real pleasure in acknowledging.

The first pair of feet does not differ in structure from the others, and consists of two stalks, of nearly equal length, each composed of three articulations, and each articulation giving off two or three setæ. The outer branch is more slender than the inner. The fulcra or supports consist of a broad, flat plate, with several tolerably long setæ, as in the preceding species.

Hab.—Berwick Bay, 1835. Dover, North Foreland, September 1849.

Genus 3—ARPACTICUS.*

CYCLOPS, *Müller, Tilesius, Baird, &c.*
MONOCULUS, *Manuel, Gmelin, &c.*
ARPACTICUS, *M. Edwards, Baird, Dana* (in part).
NAUPLIUS (*pars*), *Philippi.*

Character.—Foot-jaws forming strong cheliform hands. Antennules simple. Ovary single.

1. ARPACTICUS CHELIFER. Tab. XXIX, figs. 2, 3, 3 *a-g*.

CYCLOPS CHELIFER, *Müller*, Zool. Dan. Prod., No. 2413, 1776; Entomost., 114, t. 19, f. 1-3.
— *Latreille*, Hist. Nat. Crust., iv, 269.
— *Bosc*, Man. Hist. Nat. Crust., ii, 259.
— *Baird*, Mag. Zool. and Bot., i, 328, t. 9, f. 15-22.
MONOCULUS CHELIFER, *Manuel*, Enc. méth., vii, 721, t. 264, f. 32-34.
— *Gmelin*, Linn. Syst. Nat., edit. 13th, i, 2998, No. 21.
CYCLOPS JOHNSTONI, *Baird*, Trans. Berw. Nat. Club, i. 97, t. 2, f. 4, 1835.
CYCLOPS ARMATUS, *Tilesius*, Mém. Acad. Imp. St. Pétersb., v, 366, t. 8, f. 7, 8.
ARPACTICUS CHELIFER, *Baird*, Trans. Berw. Nat. Club, ii, 154, 1845.
NAUPLIUS CHELIFER, *Philippi*, Wiegm. and Erichs. Archiv, 1843, p. 69.

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* From ἁρπαξ, rapacious.

The thorax consists of four, the abdomen of six segments, the terminating one giving issue to two long, linear, finely-serrated setæ, fully the length of the body. The upper or cephalo-thoracic segment, comprising the head, consolidated with it, is beaked, having a short conical elongation in the centre.

The antennæ (f. 3 *a*) are short, of about ten articulations in the female, and at the junction of the fourth with the fifth there is a small lateral joint in both sexes. At the fifth ring, in the male, is situated the swelling and hinge-joint. The antennules (f. 3 *b*) consist of two articulations, the first having a shoot sent off from about its centre, divided into two joints, which are furnished with several hairs; the second being terminated by five setæ, the three internal of which are the longest, and have a joint near the middle of their length.

The mandibles (f. 3 *c*) resemble very much these organs in the *Canthocamptus minutus*, the teeth, however, being more distinctly seen. The posterior foot-jaws (f. 3 *e*) are composed of three articulations, the first being long, the second short and curved, and the third forming a strong curved hook, the two terminal combined having the appearance of a strong claw.

The first pair of feet (f. 3 *f*) consists of two unequal stalks, arising from a common base of considerable length. The superior is the longer of the two, and is composed of two nearly equal stalks, serrated on their upper edge, the second terminating in three short hooks. The inferior stalk is also formed of two articulations, the first of which is much the longer of the two, and is serrated, the second being very short, and terminating in two curved hooks. The three other pairs of feet (f. 3 *g*) consist, each stalk, of three articulations, furnished with long hairs, one or two of the long terminating ones being finely serrated. The external stalk is larger and longer than the internal. All three pairs of feet resemble each other.

The supports or fulcra (f. 3 *d*) are composed each of a broad, flat body, rounded at one side, and furnished with several rather long, finely-serrated setæ.

The specimens of this species, which I have now referred to the *Cyclops chelifer* of Müller, differ in so many points from his figures and description, that in a paper upon the Berwickshire Entomostraca, read before the Berwick. Nat. Club, and since that published in their 'Transactions,' I was induced to make a distinct species of it, and named it *Cyclops Johnstoni*. Upon more minute examination, however, I have become satisfied that, notwithstanding these discrepancies, it approaches sufficiently near the *C. chelifer* to be identified with it. In describing this species, Müller says there are no articulations in the body, but that in form it is "farciminis facie."* He figures, too, only three articulations to the antennæ. These characters are so much at variance with the analogous portions of the body in all the other species of this family, that, as he mentions it as of rare occurrence, it is most probable he must have made some mistake with regard to them. Some differences also exist in his description of the first pair of feet, and the length of the caudal setæ; but they agree so well in the characteristic foot-jaws, in the beaked head, and in the general form of the animal, that I have now no hesitation in referring it to the *Cyclops chelifer* of Müller.

Hab.—Sea-shore of Berwickshire, Cockburnspath, Berwick Bay, &c.; common. Dover, North Foreland, September 1849.

2. Arpacticus nobilis. Tab. XXVIII, figs. 2, 2 *a-e*.

Arpacticus nobilis, *Baird*, Trans. Berw. Nat. Club, ii, 155, 1845;
Ann. and Mag. Nat. Hist., xvii, 416, t. 9, f. 5, 5 *a, b, c, d*.

The thoracic and abdominal portions of the body are

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* Tilesius describes his *C. armatus* as having the articulations of the body very indistinct, and uses the same expression, "farciminis facie." He alludes to the *C. chelifer* of Müller as being a fresh-water species!

distinct from each other. The thorax is composed of four segments, and is large and rounded. The abdomen consists of six slender segments, the last being bilobed, and giving off two long setæ and two short ones. The whole animal is beautifully coloured with green, red, and purple. The eye is large, of a ruby colour.

The antennæ (t. XXVIII, f. 2 *a*) are short, divided into seven articulations, all of which are setiferous. The first two are short and stout; the third is much longer, toothed on its upper edge, and giving off at its extremity several long setæ. The last four are small and short.

The antennules (f. 2 *b*) are composed of two segments, the first giving off a shoot from about the middle of its length, and the second terminating in several stout setæ.

The mandibles and anterior or first pair of foot-jaws are strong, and resemble the same organs in *Cyclops quadricornis*. The posterior foot-jaws (f. 2 *d*) are shorter, but much stouter than those of the preceding species, and consist, as in them, of the two joints and strong terminal hooked claw. The thoracic pair of feet (f. 2 *e*) differs in structure from the others. It consists of two stalks, rising from a common base; the anterior or upper stalk composed of one long joint and a very short one, which terminates in a strong claw, the posterior or inferior stalk being very short, toothed on its edge, and giving off several stout setæ. The abdominal feet resemble those of preceding species, the setæ with which they and the fulcra are provided being all plumose. The fulcra (f. 2 *c*) resemble those of *chelifer*. The setæ of the caudal segment, however, are not plumose.

This species is at least three times larger than the preceding, and the body is stouter and more rounded.

Hab.—Along with preceding in Berwick Bay, 1835. Dover, North Foreland, September 1849.

Genus 4—ALTEUTHA.[*]

CYCLOPS, *Baird*, Mag. Zool. and Bot., i, 1837.
ALTEUTHA, *Baird*, Trans. Berw. Nat. Club, ii, 155, 1845; Ann. and Mag. Nat. Hist., xvii, 416.

Character.—Foot-jaws small, simple; body flat. Two strong falciform appendages from the fifth segment of the body.

1. ALTEUTHA DEPRESSA. Tab. XXX, figs. 1, 2.

CYCLOPS DEPRESSUS, *Baird*, Mag. Zool. and Bot., 331, t. 10, f. 9-12, 1837.
ALTEUTHA DEPRESSA, *Baird*, Trans. Berw. Nat. Club, ii, 155, 1845; Ann. and Mag. Nat. Hist., xvii, 416.

The body is depressed, flat, and broad, differing in this respect very much from all the other genera described.

The thorax is composed of four segments, the first of which contains the head consolidated with it, and is much the largest, being more than equal to the three succeeding, and having the upper part projecting in a short obtuse point.

The abdomen consists of five segments, and is about one third the length of the body; the terminating segment having on each side a small lobe, from each of which issues a moderately long seta.

The eye is situated rather lower down than usual in the other species of this family, and is of a fine ruby colour.

The antennæ are short, strong, subcylindrical, setiferous, and divided into six or seven articulations; the first three of which are the largest, the last four being smaller and shorter. In the female we find a lateral ring at the junction of the fourth and fifth joints. The swelling, in the male, is situated in the fourth, followed by the hinge-joint, and terminated by a hook. The antennules are of two articulations, the latter being terminated by four short setæ. From the opaqueness of the body, and the flatness of its form, I could not distinctly perceive the mandibles or foot-jaws; except that the latter were like the corresponding organs in the Canthocamptus. The first pair of feet (t. XXX, f. 1 *a*) is composed of two stalks rising from one common base, each stalk consisting of three joints. The superior or external stalk is longer than the inferior, the last joint terminating in four short hooks. The inferior stalk terminates in several short setæ, and has a long filament at each joint. The other legs are of the same form and structure as in the preceding genera, and provided with numerous long hairs.

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[*] "Alteutha," the Town of the Tweed.

At the junction of the first with the second segment of the abdomen, there issues on each side an organ (f. 1 *b*), very much resembling the fulcra or supports we find occurring at the same part of the body in the other genera already described, only that in this little creature we observe the same sort of organ in the male as well as in the female. It consists of a broad, falciform plate, which terminates in a tolerably long, bluntish, hollow spine, having four short teeth or hollow spines (in the male) on the outer edge, the whole organ being nearly equal in length to the abdomen. In the female these organs are not quite so large as in the male, and have only two short teeth on the outer edge, both of which are situated near the base. In the female also, the second segment of the abdomen is much larger than in the male. The posterior two thirds of the thoracic segment is marked with a broad fascia of a very dark colour, with a ruby tinge in it. The two upper segments of the abdomen are marked in the same manner, but not of so deep a hue.

The ovary is single, large, round, lying right across the abdomen.

The motion of this little creature is very peculiar. It generally swims on its back, and instead of darting *forward* through the water, as the other species of this family do, it springs with a bound from the bottom of the vessel, where it rests when undisturbed, *up to the surface* of the water. For this purpose it curls its body into the form of a ball, and then suddenly returning to the straight position, springs with a sudden bound from the bottom to the surface, falling gradually down again to the same place from which it had sprung.

Hab.—Berwick Bay, 1835, not common.

Family 2—DIAPTOMIDÆ.

Character.—Head in general distinguishable from the body, though firmly articulated with the first ring of the thorax. Foot-jaws, three pairs, well developed. Legs, five pairs; the last pair differing in structure from the others, and differing also from each other in the two sexes. One eye; sometimes in male sex pedunculated. Right antennæ alone, in the male, furnished with the swollen hinge-joint.

The habits and manners of the animals of this family are very similar to those of the Cyclopidæ. Some are inhabitants of the fresh water, and others are marine. The manner of hatching their young, and the changes these undergo in their progress to maturity, are very similar; only it would appear, from Jurine's observations, that the mother must carry the ova along with her, till the young are hatched, whilst, in the Cyclopidæ, the eggs may be hatched, after they are removed from the mother.

This family contains three British genera.

1. Diaptomus.—Head distinguishable from body. Thorax and abdomen each composed of five segments. Antennules two-branched.

2. Temora.—Head consolidated with first ring of thorax. Thorax composed of five, and abdomen of three segments. Antennules two-branched.

3. Anomalocera.—Head distinguishable from body. Thorax composed of six, abdomen of four segments. Antennules not two-branched.

Genus 1—DIAPTOMUS.[*]

MONOCULUS, *Linnæus, Fabricius, Jurine, &c.*
CYCLOPS, *Müller, Desmarest, Manuel, &c.*
DIAPTOMUS, *J. O. Westwood,* Partington's Cyclopæd. Nat. Hist., art. Cyclops, 1836; Entomologist's Text-Book, 1838.
OMETHIA, *Templeton,* Trans. Ent. Soc., ii, 118, 1838.
CYCLOPSINA,[†] *M. Edwards,* 1840.
— *Philippi,* Wiegm. and Erichs. Archiv, 1843.
— *Baird,* Zoologist, i, 56; Trans. Berw. Nat. Club, ii, 154.
— *Dana,* Proc. Amer. Acad. Sc., 1847.

Character.—Head distinguishable from body, though firmly articulated with the first ring of thorax. Thorax and abdomen, each of five segments. Antennules composed of two branches. Foot-jaws not branched. Legs five pairs; the first pair having one branch of three articulations, and the other of two; the three succeeding pairs having each a branch of three joints. External ovary large, single, and lying across the abdomen.

1. DIAPTOMUS CASTOR. Tab. XXVI, figs. 1, 2, 2 *a-j.*

MONOCULUS CASTOR, *Jurine,* Hist. Nat. Monoc., 50-73, t. 4-6, 1820.
CYCLOPS CASTOR, *Desmarest,* Cons. gén., 363, t. 53, f. 5, 1825.
— *Baird,* Mag. Zool. and Bot., 324, t. 10, f. 1-8.
CYCLOPS CÆRULEUS, *Müller,* Zool. Dan. Prod., No. 2411, 1776; Entomost., 102, t. 15, f. 1-9.
— *Latreille,* Hist. Nat. Crust., iv, 265.
— *Bosc,* Man. Hist. Nat. Crust., ii, 257.
MONOCULUS CÆRULEUS, *Fabricius,* System. Entomolog., 295.
— *Manuel,* Enc. méth., t. 264, f. 1-9.
— *Gmelin,* Linn. Syst. Nat., 2997, No. 12, edit. 13th.

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[*] From δια, through; and ιπταμαι, to fly.

[†] Though the genus *Cyclopsina* has been adopted from M. Edwards by Philippi, and heretofore by myself, yet as its founder includes other species belonging to the family in it which, as I have shown above (p. 204), cannot be received, and as Mr. Westwood, four years previous to the publication of M. Edwards's work, distinctly defined the genus *Diaptomus,* I now, obeying the law of priority, assume his name; and, indeed, while Mr. Westwood's paper in which he founded the genus was still in MS. I had already indicated his name for it in the 'Trans. Berw. Nat. Club' for 1835.

Cyclops lacinulatus, *Müller*, Zool. Dan. Prod., No. 2410, 1776; Entomost. 105, t. 16, f. 4-6.
— *Ramdohr*, Beyt. zur Naturg., 7-9, t. 2, f. 4-12.
— *Latreille*, Hist. Nat. Crust., iv, 266.
— *Bosc*, Man. Hist. Nat. Crust., ii, 258.
— *Baird*, Trans. Berw. Nat. Club, i, 97.
Monoculus lacinulatus, *Manuel*, Enc. méth., t. 264, f. 15-17.
— *Gmelin*, Linn. Syst. Nat., 2997, No. 14.
Cyclops rubens, *Müller*, Entomost., 104, t. 16, f. 1-3, 1781.
— *Latreille*, Hist. Nat. Crust., iv, 266.
— *Bosc*, Man. Hist. Nat. Crust., ii, 258.
— *Baird*, Trans. Berw. Nat. Club, i, 97, t. 2, f. 2 (the young).
Monoculus rubens, *Fabricius*, op. cit.
— *Manuel*, Enc. méth., t. 264, f. 10, 11.
— *Gmelin*, Linn. Syst. Nat., i, 2997, No. 13.
Diaptomus Castor, *Westwood*, Partington's Cyclop. Nat. Hist., art. Cyclops, 1836.
Disptomus Castor *Baird* (*misprint*), Trans. Berw. Nat. Club, i, 97, 1835; Philosophical Transactions, No. 288, 1703, f. 6 of accompanying plate.
— *Baker*, Microsc. made Easy, 93, t. 9, f. 2.
Cyclopsina Castor, *M. Edwards*, Hist. Nat. Crust., iii, 427, 1840.
— *Baird*, Trans. Berw. Nat. Club, ii, 154, 1845.
Glaucea rubens, *Koch*, Deutsch. Crust., h. xxxv, t. 4 (male), t. 5 (female).
Glaucea cærulea, *Koch*, l. c., xxxv, t. 6.

Description.—The head may be easily distinguished from the body, though it is firmly articulated with the first segment of the thorax.

The thorax consists of five rings, the first being considerably the largest.

The abdomen is composed of five articulations also, the last being divided at extremity into two lobes, each of which gives origin to five plumose setæ.

The eye is large, of a fine ruby colour; and we can distinctly see the muscles which move it, and of which there are several.

The antennæ are large organs, of great length, and strong. They are formed of about twenty-six articulations, each furnished with one or more setæ, the last terminated by five of different lengths. In the male, the right antenna alone has the swelling and hinge-joint, which characterise the sex. This joint is formed in the same manner as that in the Cyclopidæ.

The antennules (t. XXVI, f. 2 *a*) are of considerable size, and bifid; two branches of unequal length, arising from a common footstalk. The shorter of the two can be moved backwards or forwards at the pleasure of the animal, and consists of six articulations, the first of which is stout, and inserted into the common footstalk, and has four stout setæ springing from its edge. The second, third, fourth, and fifth are very short, and each is furnished on its edge with a stout seta; while the last is of considerable length and is provided at its extremity with three long setæ. The longer branch is composed of three joints. The first is articulated with the body of the animal, and the third terminates in several long filaments, which have a joint in the middle of their length, adding much to their suppleness. These organs the little creature puts into rapid action, and so causes a regular whirlpool in the water, which attracts every object into its centre, and guides them into its mouth.

The labrum or lips consist of two small, somewhat foliated-looking bodies, almost transparent, which, when any object fit for food passes into the mouth, are seen to separate from each other and open a passage for it.

The mandibles (f. 2 *b*) resemble those of the Cyclops (already described), but have the palpiform branch much larger and bifid.

The neck terminates in a horny acute point, under which are six small teeth on the same plane.

The foot-jaws are three pairs in number. The anterior or first pair (f. 2 *c*, *d*) consists of a broad, heart-shaped plate, with a smaller one of the same form attached to its upper edge, both having numerous setæ springing from them, in the larger consisting of four on one side, and eight on the other; while a third, or smaller plate, bifid, and equally beset with a number of hairs, springs from the upper edge of the centre plate. The second pair (f. 2 *e*) is flat and stout, composed each of a body which is indistinctly divided into three segments. The anterior edge is prominently marked with several eminences, from each of which spring two rather long setæ, directed towards the mouth. The posterior or third pair of foot-jaws (f. 2 *f*) is much larger than the preceding, and is formed of seven rings, the first two of which are large in proportion to the other five.

The legs are five pairs in number, and the first four, as in the Cyclopidæ, are double. The basal portion consists of two articulations. In the first pair (f. 2 *g*) the external branch consists of three joints, and the internal of two. In the three succeeding pairs (f. 2 *h*) each of the branches is composed of three segments, and all are furnished with plumose setæ. The fifth pair is differently formed from the others, and is strong and well-developed compared with that of the Cyclopidæ. They differ also from each other in the two sexes. Those of the male (f. 2 *i*) are almost cylindrical, and consist of two unequal branches arising from a common footstalk. The right branch is much the larger of the two, and is formed of three articulations, the last of which is terminated by a long and strong hook. The left has four rings, and is terminated by two short spines. This pair of legs is erroneously considered by Jurine to be the sexual organs; the shorter of the two branches containing, he believes, the organ itself. In the female (f. 2 *j*) the right branch is very much the larger of the two, and consists of three joints, the last of which is terminated by a strong curved claw. The left branch is very slender, composed of only one joint, and a terminal spine. These organs in the female are called, by Jurine, the "fulcra, or supports of the external ovary."

The dorsal vessel, or heart, is very distinctly to be seen under the second and third segment of the body. It is oval, and gives origin to two vessels of equal size, one going to the head, and the other to the abdomen, and has another organ attached to it, which is called by Jurine the auricle. The pulsations of the heart are very frequent, from 112 to 120 in the minute. Underneath the first segment of the abdomen in the female, is the vulva, or external organ. It forms also the opening of the canalis deferens, and through it the ova pass into the external ovaries. Above this opening we see a triangular, reddish body, which Jurine calls the *operculum vulvæ.*

In some specimens of this species, we occasionally see on each side of the abdomen two, four, or six elongated bodies, the direction of which is invariably backwards. In the females, to which sex they are principally confined, they are found adhering round the operculum vulvæ, and when they have been noticed in the male, they have been seen adhering to the base of the posterior feet. These bodies were noticed by Müller, and are called by him the *laciniæ.* He regarded them as some particular organs belonging to the animal, and they were considered by him as sufficient to constitute the individual possessing them into a distinct species, which he describes under the name of *Cyclops lacinulatus.* The use of these organs, however, he was totally ignorant of. Jurine also observed them, and says, that at first he was disposed, like Müller, to regard them as peculiar organs, and that from their presence he was led to infer that the individuals charged with them were a distinct species. After very attentive observation, however, he found the number to be irregular; he found them also occasionally in males, and he observed that they would separate spontaneously from the body of the animal. Not being able to discover any use for them, he conjectured them to be infusory animalcules. Jurine states, that it is in the months of March and April that these bodies are to be met with; but the only time I have ever seen a specimen of Diaptomus with them attached, was in the month of October. It was taken from Yetholm Loch, in Roxburghshire; but an accident occurring to the vessel in which it was placed, I was prevented from making any lengthened observations upon them.

M. Siebold,* however, has had opportunities of studying them carefully, and the results of his observations, with his remarks on the method of copulation of Diaptomus, are so interesting and striking, that I will give them here at some length. The male having only the right antenna provided with the swelling and hinge-joint, seizes hold of the tail of the female with it, and grasping it tightly, curves himself up to her ventral surface. He then surrounds the base of her tail with the large hook of his fifth pair of feet. The female is at first restless, but she soon becomes more tranquil, and in this position they both fall to the bottom of the water, remaining fixed sometimes for hours together. The act of copulation itself, however, lasts only for a short time; but what takes place during that short interval is very remarkable. "A cylindrical tube, filled with a spermatic liquor, escapes from the sexual organ of the male, immediately after the connection takes place; the male seizes this tube as soon as it has made its exit, and fastens it against the abdomen of the female, beneath the vulva."† The fifth pair of feet is most probably the organ by which the male seizes the tube; but Siebold did not distinctly ascertain the fact. When it escapes from the male organ, it is by its rounded extremity; and it would appear, that when the animal lays hold of it, he presses the neck of the tube with the tip of his foot against the first joint of the tail of the female, and as the neck of the tube contains a glutinous substance, it immediately adheres.

Such is the operation, as described by Siebold from personal observation, and from which he concludes, that it is with the matter in these tubes that the female is fecundated. No female, he says, possesses a tube before copulation; but immediately after the act is accomplished we see one fastened to her, near the vulva. If a male be examined, when in heat and before copulation take place, a body like one of these tubes may always be seen concealed in the sexual parts; but immediately after copulation has taken place, nothing of the kind can be observed in a state of development. Jurine, as I have observed above, had occasionally seen them in the male, attached to the base of the posterior feet; and Siebold states, that once, upon separating a pair in the act of copulation, he found a seminal tube attached to the end of the last pair of feet of the male, "apparently," he says, "before he had had time to rid himself of the body."

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* Mém. de la Soc. des Scrutateurs de la Nature, de Dantzig, iii, part ii, 1839; Ann. des Sc. Nat., 2d ser., xiv, 26-38, 1840.

† Ann. des Sc. Nat., xiv, 28.

It has been observed, that the males of this species are very lustful, and they have been seen to attack in succession several females, some of them even such as had had connection immediately previous with other males, or that had external ovaries suspended from their abdomen, so that it is not uncommon to find two, three, four, and even five of these tubes in the same female. These tubes are all similar in size, form, and contents. They are straight, and scarce extend in length beyond the point of the tail. They are composed of a colourless, solid envelope, which is rounded at its inferior free extremity, and terminates at its upper end in a short, narrow neck, provided with an opening. Each tube contains three different kinds of matter: one is white and thick, of a glutinous nature, extending the whole length of the tube, and is coagulable in water; the second consists of a great number of very small, oval, well-formed bodies, which Siebold considers the real zoosperms of the animal; while the third is composed of a mass of oval bodies of a similar size, and composed of very fine granules. This latter granular portion of matter occupies the inferior half of the capsule; the second portion lies in the upper half, while the neck only is filled with the first kind, or the glutinous substance. As soon as the tube quits the sexual organ of the male, the relative situation of these substances changes. Immediately it comes in contact with the water, the third or granular mass swells, the little oval, granular bodies become round, swell more and more, till at last they expel the first or glutinous mass which is lodged in the neck, and take its place. When the glutinous mass is expelled, this granular substance continues to swell still more, till at last it expels the second substance, or the zoosperms, also. As soon as the glutinous matter touches the water, it coagulates, and as it continues to flow out, it leaves a canal in the centre of the part already expelled and coagulated, which gradually becomes lengthened and somewhat undulated. When all the glutinous matter has escaped, the zoosperms follow immediately, and pass through the canal in the coagulated part, so that by the time they reach the end of this sort of canal, they are close to the vulva.

"From all this," says Siebold,* "it appears—1st. That the male does not accomplish a true coition. 2dly. He attaches to the female, during copulation, a tube filled with spermatic liquor. 3d. This spermatic tube contains, beside the zoosperms, two substances, of which one (the expulsive matter) swells by the influence of the water, and chases out the whole contents of the tube. The other substance (the glutinous matter) coagulates in the water, leaving in the middle of the mass a canal, by which the zoosperms arrive at the vulva. 4th. The zoosperms, situated in the neighbourhood of the vulva, penetrate in a manner as yet unknown beneath the operculum vulvæ, and probably in this manner fecundate the eggs, which some time later quit the sexual opening of the female. 5th. One and the same female is often covered with spermatic tubes at short intervals by different males. 6th. One and the same male appears able to furnish more than one single tube from its single sexual organ."

These observations of M. Siebold are very curious and highly interesting; they appear to have been made with much care: but I am not aware of their having ever been confirmed by any succeeding naturalist.

Jurine distinctly and with truth asserts, that the three species which Müller makes, the *Cyclops cæruleus, rubens,* and *lacinulatus*, are mere varieties of one species. This, from the resemblance he fancied he saw in the abdomen of the female, when loaded with eggs, to the tail of a beaver, he has named *Monoculus Castor*. The *cæruleus* and *rubens* only differ in colour, and the *lacinulatus*, as shown above, is merely a female charged with spermatic tubes. I have not met with any individuals of a blue colour, all that I have ever examined in this country being either of a transparent hue or of a delicate red. It is a very beautiful species, and is the most elegant of any of this section: "Son port," writes Jurine, "est élégant; sa manière de s'élancer dans la liquide est noble et hardie; ses mouvements sont libres et faciles; tout enfin annonce chez lui une supériorité qui caractérise la grandeur de l'espèce à laquelle il appartient."*

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* Loc. cit., p. 37.

This animal is about 1½ line long.

Hab.—In ponds and slow-running water. Common in the neighbourhood of London, &c., especially in spring and autumn.

Genus 2—TEMORA.†

MONOCULUS, *Gunner, Fabricius, Manuel, Gmelin.*
CYCLOPS, *Müller, Latreille, Lamarck, Bosc, Leach,* Edin. Enc.
CALANUS, *Leach,* Dict. Sc. Nat.
— *Templeton,* Trans. Ent. Soc., ii.

Character.—Head consolidated with first segment of thorax. Thorax composed of five, abdomen of three segments. Antennules two-branched. Legs five pairs, the first four having each a branch of two articulations only.

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* Hist. Monoc.

† "Temora," the palace of the ancient kings of Ireland.

1. TEMORA FINMARCHICA. Tab. XXVIII, figs. 1, 1 *a-g*.

MONOCULUS FINMARCHICUS, *Gunner*, Act. Hafn., x, 175, f. 20-23, 1765.
CYCLOPS FINMARCHICUS, *Müller*, Zool. Dan. Prod., No. 2415.
CYCLOPS LONGICORNIS, *Müller*, Entomost., 115, t. 19, f. 7-9.
— *Lamarck*, An. s. Vert., v, 189.
— *Latreille*, Hist. Nat. Crust., iii, 266: Gen. Crust. et Insect., ii, 26.
— *Bosc*, Man. d'Hist. Nat. Crust., ii, 259.
— *Leach*, Edinb. Enc., art. Crustaceology.
MONOCULUS LONGICORNIS, *Fabricius*, Ent. Syst., ii, 501, No. 52.
— *Gmelin*, Linn. Syst. Nat., 2997, No. 15.
— *Manuel*, Enc. méth., 720, t. 264, f. 11-14.
CALANUS FINMARCHIANUS, *Leach*, Dict. Sc. Nat., xiv, art. Entomost.
— *Desmarest*, Cons. gén. Crust., 364.
— *Krusenstern's* Voyage, Atlas, t. 22, f. 14.

Description.—The body is of a dark brown colour (preserved in spirits).

Thorax consists of five segments; the first, with which the head is consolidated, is the largest, the other four gradually becoming smaller as they descend.

The abdomen has only three segments, and has a long, bifid, caudal joint, terminated by two short, stout setæ, serrated on the edges.

The antennæ or rami (t. XXVIII, f. 1 *f*) are very long, exceeding the body in length, though not quite equal to the body and abdomen together, and are composed of twenty-four short articulations.

The antennules (f. 1 *b*) are two-branched. The first branch consists of two joints, the latter of which is deeply notched at the extremity, and is terminated by seven or eight long hairs. The second branch has six articulations, the first and last of which are of equal length. and the four intervening ones are very short. The first joint gives off from its inner edge four long setæ, each of the short ones gives off one, and the last is terminated by two or three of still greater length.

The mandible and its palpiform branch (f. 1 *a*) are well developed, and, as well as the three pairs of foot-jaws (f. 1 *c*, *d*, *e*), exactly resemble those of Diaptomus.

The four anterior pairs of feet (f. 1 *g*) are all alike, and consist of a basal stalk of two articulations, and two branches of unequal size. The inner branch is much the smaller, but both are divided into two joints. The posterior or fifth pair is almost exactly similar to the corresponding pair in Diaptomus.

I have never found this species alive, having only seen it preserved in spirits.

Hab.—Coast of Ireland, W. Thompson, Esq.

Genus 3—ANOMALOCERA.*

ANOMALOCERA, *Templeton*, Trans. Ent. Soc., ii, 35, 1837.
IRENÆUS, *Goodsir*, Edin. New Phil. Journ., xxxv, 339, 1843.
PONTIA, *Baird*, Trans. Berw. Nat. Club, ii, 156.

Character.—Head distinguishable from body; furnished with a beak, which is divided at apex into two sharp points, and at the base terminates on either side in a sharp hooked spine. Thorax divided into six, abdomen into four segments. Antennules not two-branched. Foot-jaws strongly developed. Eye in male pedunculated.

1. ANOMALOCERA PATERSONII. Tab. XXVII, figs. 1 *a-i*; 2 *a-c*.

ANOMALOCERA PATERSONII, *Templeton*, Trans. Ent. Soc., ii, 35, t. 5, f. 1-3.
PONTIA PATERSONII, *Baird*, Trans. Berw. Nat. Club, ii, 156.
IRENÆUS SPLENDIDUS, *Goodsir*, Edin. New Phil. Journ., xxxv, 339, t. 6, f. 12-17, t. 4, f. 1-9.

Description.—The head is distinguishable from the body, but firmly articulated with the first segment of the thorax. It is of a sub-triangular shape, with a curved, sharp-pointed beak (t. XXVII, f. 1 *g*, *f*; f. 2 *a*, *b*) and has near its junction with the first thoracic ring, on each side, a short, curved, sharp spine.

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* From *ανωμαλος*, dissimilar; and *κερας*, a horn.

The eye is single, in the male fixed upon a short peduncle (f. 1 *g*), and projecting forwards and slightly downwards; in the female sessile. "It is of a beautiful dark-brown colour, with a shade of purple; a circular space at the extremity is colourless, and sparkles brilliantly." *

The thorax is elongated, and consists of six segments, the last of which is narrower than the others, truncated, and terminates on each side in a point. Antennæ long, about two thirds the length of the whole body. They are composed of numerous articulations, about twenty-five in number, each provided with one or more short setæ. In the male the right antenna alone is provided with the swelling and hinge-joint. The swollen part is particularly large, and club-shaped, "and running up through the centre of the swelling may be seen a muscle, which goes to be attached to the hinge-joint."†

The antennules (f. 1 *a*) consist of a single branch, which is divided into three joints, the terminal joint being broad, and furnished with several long setæ. The basal joint sends off from its internal side a small, slender twig, which is provided at the extremity with three or four setæ. The labrum or lip is well developed, and consists of a projecting semi-oval plate, and two lateral lobes of considerable size.

The mandible (f. 1 *b*) is in form of a strong plate, furnished with five stout teeth on its internal extremity, and having a rather large, palpiform branch from its upper edge, divided into two smaller branches. Each of these is formed of two articulations, the terminal one giving off at its extremity several long, plumose setæ. The jaws are only rudimentary organs.

The foot-jaws are three pairs in number. The first pair (f. 1 *c*) is of moderate size, each composed of a stout basilar joint or plate, which at its extremity gives off two or three other flat joints or plates, all of which are provided with several long setæ. The second pair (f. 1 *d*) is larger, formed of a tolerably strong basilar joint, which is lobed at its extremity, and a slender branch of five articulations. The lobes of the basilar joint, and the articulations of the slender branch, are all provided with several plumose setæ of considerable length. The third pair (f. 1 *e*) is large, and strongly developed, and consists of two stout joints, which have on the inner edge several lobes, furnished with very long, plumose setæ, directed forwards and upwards, so as to meet with the plumose setæ of the antennules.

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* Goodsir, loc. cit., 339. "The peduncle of the eye is of a dark blue."—Paterson, quoted by Templeton, loc. cit.

† Ibid., ibid.

The feet are five pairs in number. The first four pairs (f. 1 *h*) are all alike, and formed for swimming. They consist of a common joint at the base, divided into two articulations, and two longer stalks. The internal stalk is divided into two joints, and the external, which is the larger of the two, into three, all furnished with numerous setæ. The fifth pair is different from the others, and from each other in the different sexes. In the female (f. 2 *c*) it is small, formed of a basilar joint of two articulations, and a smaller and more slender joint, of three articulations. At the base of the second basilar joint, on the inner side, a small, short branch springs, formed of one articulation. In the male, this pair of feet (f. 1 *i*) is large, composed of two stalks, both of which appear to spring from the body without a common foot-stalk. The one is simple, consisting of three large joints, which terminate in two or three slender, styliform setæ, while the other is terminated by a strong claw, or prehensile hand.

The abdomen consists of four segments, the last of which gives off two caudal lamellæ of considerable length, each provided with five rather short and plumose setæ. These bodies seem adapted for assisting the animal in swimming. Length of animal about three lines.

From a careful examination of specimens sent me by Mr. Thompson, of *Anomalocera Patersonii* from Ireland, and *Irenæus splendidus* from Scotland, from an examination of the specimens of *Irenæus* sent by Mr. Goodsir himself to the British Museum, and from the figures of the two given by Mr. Templeton and Mr. Goodsir, I have no doubt they are identically the same. The tubular organ in which the eye is situated in Irenæus, and which forms, according to Mr. Goodsir, the chief generic character, is merely the peduncle upon which the eye is placed, and which is well described in Anomalocera, by Mr. Templeton. Mr. Goodsir's description of Irenæus seems to have been taken from a male specimen. He describes the little animal, when alive, as of a very brilliant appearance. "The whole animal," he says, "gives forth a kind of luminous appearance, which is apparently caused by the splendid metallic colours with which it is adorned. The prevailing colours are sapphirine and emerald."

"The colour of the animal," says Mr. Paterson, as quoted by Mr. Templeton, "is a bright green, mottled with darker shadings; the green colour is very fugacious, and observable only in recent specimens .... The first time," he continues, "on which I took any of these, was in crossing the ferry at the mouth of Larne Lough, county Antrim, in the evening of the 2d of May. They were so numerous, that in the space of fifteen minutes above three hundred were taken. Though kept in a glass jar of sea-water they all died during the night, and were almost colourless next morning .... They swim with a lively and constant motion, and jerk themselves out of the way when pursued. They form a portion of the food of a tentaculated Beroe." (pp. 39, 40.)

Hab.—Mouth of Larne Lough, county of Antrim, Mr. Templeton, W. Thompson, Esq. (*Anomalocera*); Frith of Forth, Mr. Goodsir; Kyles of Bute, W. Thompson, Esq. (*Irenæus*); Brit. Mus.

Family 3—CETOCHILIDÆ.*

PONTIENS, *M. Edwards*, Hist. Nat. Crust., iii, 412.
PONTIADÆ, *Baird*, Trans. Berw. Nat. Club, ii, 155.

Character.—Head distinguishable from body, but firmly articulated with the first ring of thorax. Foot-jaws three pairs, strongly developed. Legs five pairs. Eyes two in number. Right antennæ alone, in male, furnished with the swollen hinge-joint.

The individuals hitherto discovered belonging to this family are not numerous. The only British genus yet noticed is the genus Cetochilus.

Genus CETOCHILUS.†

Roussel de Vauzème, Ann. des Sc. Nat., 2d series, i, 333.
M. Edwards, Hist. Nat. Crust., iii, 421.
Goodsir, Edin. New Phil. Journ., xxxv, 339.
Baird, Trans. Berw. Nat. Club, ii, 156.

Character.—Head furnished with two small, styliform prolongations. Antennules of two branches, of nearly equal size. Foot-jaws not branched. Thorax of six, abdomen of four segments. Last pair of feet of the same formation as the others.

This genus was established by Roussel de Vauzème, in the 'Ann. des Sc. Nat.,' second series, i, 1834; and he there gives a very interesting account of its use, as constituting, in a great measure, the food of the whale. Vauzème was attached to a vessel employed in the whale fishery in the Southern Ocean; and for four months the crew were engaged in the neighbourhood of the island of

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* The term *Pontia* having been preoccupied by a genus of Lepidoptera, it may become necessary to alter the name of M. Edwards's genus of this family. Mr. Dana, indeed, has done so, changing it to Pontella. I have therefore used the term *Cetochilidæ* as not liable to any objection, and the more especially as the genus Cetochilus is the only one of the family found in Britain as yet.

† From κητος, a whale; and χιλος, food.

Tristan d'Acunha, in the South Atlantic, without his ever having been able to observe what formed the food of the whales. Leaving that quarter, however, at the end of that time, and steering for Cape Horn, he one morning, in the month of February, observed the surface of the sea streaked with red lines, of several miles in extent, and giving the appearance of blood to the water. The experienced sailors on board immediately announced that they had now reached the *pasture* of the whales. Accordingly, they very soon afterwards saw them sporting about in the midst of these ruddy banks. Upon examining the water thus coloured, Vauzème found it caused by an immense number of small Crustaceans, which were of a red hue. They swarmed in myriads on the surface of the sea, and, when the wind was boisterous, a whole bank of them would be taken up by a wave, and carried on board the vessel, covering the deck, and the clothes of the sailors. The whales swallowed them in myriads, and they served for food not only to them, but to the Cirrhopodes (the Coronulæ and Tubicinellæ), which live as parasites upon their skin. The American fishers on that station informed him that these little creatures, in the fine weather of October and November, remain concealed deep under the water, but that after that time, they come to the surface to lay their eggs. In our own seas, this same kind of Crustacean has also been observed to be the food of cetaceous animals.

In the Frith of Forth, Mr. Goodsir informs us,* that during the summer months, great masses of animal matter abound on the surface of the sea, and that this had long been noticed by the fishermen on the coast, and was called by them *maidre*. Upon examining this matter, in the neighbourhood of the Isle of May, he found it to consist of Cirrhopodes, Crustaceans, and Acalepha; but that of all these, the Entomostracous Crustaceans abounded in the greatest quantity, "or rather masses," he observes,

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* Edin. New Phil. Journ., xxxv, 88.

"for it gives a faint idea, to speak of numbers .... On looking into the water," he continues, "it was found to be quite obscured by the moving masses of Entomostraca, which rendered it impossible to see anything even a few inches below the surface. But if a clear spot is obtained, so as to allow the observer to get a view of the bottom, immense shoals of cod-fish are seen swimming lazily about, and devouring their minute prey in great quantities. Occasionally small shoals of herrings are seen, pursuing them with greater agility .... Great numbers of Cetacea often frequent the neighbourhood of the island at this time, droves of dolphins and porpoises swimming about with great activity; and occasionally an immense rorqual may be seen, raising his enormous back at intervals from the water, and is to be observed coursing round and round the island."

On one of his visits to the Isle of May, he observed that at a considerable distance from the land, the sea had assumed a slightly red colour, and that this became deeper and deeper, the nearer he approached the island. The water too, he noticed, presented a very curious appearance on the surface, as if a quantity of fine sand were constantly falling upon it. At first he thought this might proceed from light rain, but, upon more attentive examination, he found both the red hue of the water and the motion on its surface proceeded from an immense number of small Entomostraca. Some of these he collected, and found them to be a species of the genus Cetochilus.

1. CETOCHILUS SEPTENTRIONALIS. Tab. XXIX, fig. 1 *a-g*.

Goodsir, Edin. New Phil. Journ., xxxv, 339, t. 6, f. 1-11.
Baird, Trans. Berw. Nat. Club, ii, 156.

Description.—This animal is about one and a half, or two lines long, of a bright red colour, and slightly translucent. The thoracic and abdominal portions of the body are distinct, each portion being divided into six segments.

The cephalo-thoracic segment is furnished with two styliform appendages (t. XXIX, f. 1 *a*), instead of having the moveable beak of Anomalocera; these very much resemble antennæ in appearance, and are described as such by Goodsir.*

The antennæ are very long and slender, being longer than the body of the animal, and composed of twenty-four articulations, the twenty-second and twenty-third are each provided with a long seta, pointed downwards and inwards.

The antennules (f. 1 *c*) consist of two branches, arising from a common footstalk, and are of nearly equal length. The one is divided into two articulations, the first of which is the longest, and is furnished with a long seta at its extremity, the second having its extremity armed with a number of very long setæ; the other consists of two articulations also, the first of which is considerably bent, flattened, and armed with eight long spines on its inner edge; the second much shorter, and having two long setæ on its inner edge, and three from the extremity. The eyes are two in number, but are exceedingly small.

The mandibles (f. 1 *b*) consist, as in Anomalocera, of a strong plate, having a good many teeth on its inner extremity, the most external one being strong, and slightly curved; and a palpiform branch arising from its upper surface, which is composed of two branches, rising from a common footstalk, one branch being divided into two articulations, and the other having only one.

The first pair of foot-jaws (f. 1 *d*) resembles much the same organs in Anomalocera, consisting of a basilar joint, not so heart-shaped, with two other articulations, the last being very deeply notched, or lunate, instead of being cleft to the base, but all armed with long setæ. The second (f. 1 *e*) is composed of two articulations, each of which is knobbed on its inner edge, and armed with twelve long, finely-plumose setæ, those of lower joint arising in pairs. The third pair of foot-jaws (f. 1 *f*) is composed of seven articulations, the basal being the largest, the others diminishing in size as they succeed, and all armed with a number of long setæ on the inner edge.

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* Loc. cit.

The legs are five pairs, all formed alike. They consist (f. 1 *g*) of a common footstalk, of two joints, and two branches, each of which is divided into three articulations. The external branch is much the larger of the two, and has the last articulation the longest, and armed with several rather long setæ. The internal branch is about as long as the first two segments of the external portion, and the articulations are short and setiferous. The fifth pair is formed like the others.

The abdominal portion of the body is small and slender, the animal generally carrying it curved upwards. The last segment is bilobed, and each lobe gives off five tolerably strong setæ or spines. The alimentary canal consists of a simple straight tube.

Hab.—Frith of Forth, H. Goodsir, W. Thompson, Esqrs.

Genus—NOTODELPHYS.*

The genus Notodelphys of Allman must form the type of a new family. Till we are better acquainted with it, we must place it here provisionally, as it has many things in common with both the Cyclopidæ and Cetochilidæ, though it differs materially from both.

Character.—One eye. Head and first ring of thorax consolidated together. Thoracic portion of body consists of four, and abdominal also of four segments. Superior antennæ many-jointed; inferior prehensile. Foot-jaws, four pairs. Ovary consists of a large sac, placed behind the last thoracic ring, and within the parietes of the body.

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* From νωτος, tergum, back; and δελφυς, matrix or womb.

BIOLOGICAL

Only one species has as yet been observed, which Mr. Allman has described at length in the 'Annals and Magazine of Natural History' for July 1847. It is found swimming freely in the branchial sac of the *Ascidia communis*, and has been collected in various parts of Ireland. It was first publicly noticed by Mr. Paterson of Belfast, who briefly mentioned it at the meeting of the British Association in 1843. The species has been named by Allman—

1. NOTODELPHYS ASCIDICOLA. Tab. XXX, figs. 7, 8.
Allman, Ann. Mag. Nat. Hist., xx, 1-9, t. 1, 2, f. 1-22.

The cephalo-thoracic segment is prolonged anteriorly into a kind of beak, which is not moveable. Attached to this segment we find the eye, two pairs of antennæ, the organs of the mouth, and one pair of natatory feet.

The eye is situated, as in the Cyclopidæ, in the centre of the superior and anterior portion of this segment. It is tolerably large, and is single.

The superior antennæ consist of about twelve short articulations, each provided with one or more setæ. The inferior antennæ (f. 7 *a*) are not branched, and are formed of four joints, the last of which is in shape of a curved prehensile claw.

The labrum is well developed, and the mandibles (f. 7 *b*) are strong organs, furnished with several stout teeth on their cutting edge.

The first pair of foot-jaws (f. 7 *c*) consists each of a flattened peduncle and two branches; one having six, the other three articulations, and bearing several long, stout, and finely plumose setæ. The second pair of foot-jaws (f. 7 *d*) is very similar to the first, but their two branches have fewer joints; one having three, and the other only one, but both terminated by plumose setæ. The third pair (f. 7 *e*) is composed of five articulations, the basal being very large, and the succeeding small, and furnished with stiff, not plumose setæ. The fourth pair (f. 7 *f*) is smaller, formed of three joints, and having the setæ which spring from them partially plumose.

The feet are four pairs in number, and are all alike (f. 7 *g*). They consist, each of two branches, springing from a basal lamina of two joints, and each branch composed of three articulations, copiously furnished on their inner edge with plumose setæ. Each of these feet is attached to a corresponding segment of the thorax.

The abdomen is somewhat cylindrical, and terminates in two caudal appendages, each carrying at the extremity four short, plumose setæ. The fourth segment of the body is of a peculiar formation, having in its dorsal portion a large hollow receptacle for receiving and containing the ova. In the angle between this sac and the upper surface of the ring, of which it forms a part, there is an opening by which the eggs escape when they have arrived at maturity. At first emerging from the ovum the young animal is very like in form to the young of the Cyclops; but its changes have not been traced from this larva state to its full growth.

Hab.—Belfast Bay; Strangford Lough, county Down; W. Thompson and G. C. Hyndman, Esqrs. Killery Bay, county Galway; R. Ball and W. Thompson, Esqrs. Bangor, county Down; R. Paterson, Esq. Glandore Harbour, county Cork, Dublin Bay, and Southampton Water; George J. Allman, Esq. In the branchial sac of the *Ascidia communis.*

Legion III—PÆCILOPODA.[*]

Pæcilopoda, *Latreille,* Cuv. Règne An., iv.
— *Desmarest,* Cons. gén. Crust.
— *Leach,* Dict. Sc. Nat., xiv, 524.
— *Roux,* Crust. de la Méditerr.
— *Baird,* Trans. Berw. Nat. Club, ii.
Thecata, *Latreille,* Hist. Nat. Crust., iv; Gen. Crust. et Insect., ii.
— *Leach,* Edin. Encyclop., art. Crustaceology.
Branchiopodes parasites, *Lamarck,* An. s. Vert., edit. 2d, v. 200.
Crustacés suceurs (*pars*), *M. Edwards,* Hist. Nat. Crust., iii.
Parasita, *Burmeister,* Beit. zur Naturg. der Rankenfussen, p. 54.
Cormostomata, *Dana,* Proc. Am. Acad. Arts and Sc., 1849, p. 53.

Character.—Mouth not possessed of organs fitted for mastication, having instead an apparatus adapted for sucking. Feet, partly formed for walking or prehension, and part branchiferous, and fitted for swimming. Body, in the greater number, inclosed almost totally within a buckler, consisting generally of one piece, occasionally of two. Parasitical upon fishes, &c.

Order SIPHONOSTOMA.[†]

Siphonostoma, *Latreille,* Cuv. Règne Anim., iv.
— *M. Edwards,* Hist. Nat. Crust., iii.
— *Roux,* Crust. de la Méditerr.
— *Baird,* Trans. Berw. Nat. Club, ii.
Pneumonura, *Latreille,* Hist. Nat. Crust., iv; Gen. Crust. et Ins., ii.
— *Leach,* Edin. Encyclop., art. Crustaceology.
Caligacea, *Dana,* Proc. Am. Acad. Arts and Sc., 1849, p. 53.

Character.—Mouth furnished with a siphon, which possesses styliform mandibles. Thorax composed of several distinct rings, and having three or four pairs of feet. Foot-jaws well developed.

M. Edwards divides the order Siphonostoma into two families, the Peltocéphales, and the Pachycéphales.

The Peltocéphales are distinguished by their having their head, in the form of a buckler, furnished anteriorly with frontal plates and short antennæ consisting of two flattened joints. In the Pachycéphales, on the contrary, the head is not shield-shaped; there are no frontal plates, and the antennæ are of considerable length, composed of five or six articulations.

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[*] From ποικιλος, various; and πους, foot.

[†] From σιφων, a tube; and στομα, a mouth.

TRIBE 1—*PELTOCEPHALA.*[*] *M. Edwards.*

In all the genera belonging to this section we distinguish a head, a thorax, and an abdomen.

The head is generally larger than both thorax and abdomen together, is of a rounded form, somewhat truncated posteriorly, and having in the front part two small plates stretching across transversely.

The thorax varies in the different families, sometimes consisting of only two articulations, at others of three; and, in some instances, even of four. In some it is composed of articulations, which present nothing remarkable in their structure, whilst in others these are covered with plates, or broad flat scales, which resemble very much the parts of some insects called the Elytra.

The abdomen is always very small, and is terminated either by two small ciliated plates, or by a body consisting of three leaflets.

The antennæ are small, and are only one pair, composed of two or three short, simple articulations.

The mouth-apparatus consists of a large well-developed sucking-tube and appendages, adapted for puncturing the skin of the animals upon which they live as parasites, and for sucking the juices of their bodies; and three pairs of foot-jaws, constructed for enabling them to fix themselves upon their prey.[†]

Their feet are four pairs, the greater number in general being adapted for swimming.

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[*] From πελτη, a short shield; and κεφαλον, head.

[†] Vide the more full description of these parts in *Caligidæ.*

They are all parasitic upon fishes and other aquatic animals; and, when young, undergo a series of metamorphoses like what takes place in the Cyclopidæ.

Family—ARGULIDÆ.

Arguliens, *M. Edwards,* Hist. Nat. Crust., iii.
Argulidæ, *Leach,* Dict. Sc. Nat., xiv.
— *Desmarest,* Cons. gén. sur les Crust., 329.
— *Baird,* Trans. Berw. Nat. Club, ii, 157.
Argulina, *Kroyer,* Tidsskrift, i, 202.
— *Burmeister,* Beit. zur Naturg. der Rankenfuss.

Character.—Head in form of a large circular-shaped shield. Antennæ short, thick, two-jointed; second pair of foot-jaws absent, being replaced by a pair of large suckers.

Genus—Argulus.

Argulus, *Müller,* Entomostraca.
— *Jurine fils, Lamarck, Latreille,* Cuv. Règne Anim., iv.
— *Leach, Desmarest, Burmeister, Herrick and Dana, M. Edwards, &c.*
Monoculus, *Linnæus, Fabricius, Cuvier, Manuel, &c.*
Ozolus, *Latreille,* Hist. Nat. Crust., &c.
Binoculus, *Geoffroy, Latreille,* Genera.

Character.—As there is only one genus yet known, the characters given to the family will suffice also for the genus.

Bibliographical History.—Baker is the first author in this country who seems to have taken notice of the Argulus. In his 'Employment for the Microscope,' 1753, he gives a figure of one which he tells us "was found sticking to a large carp just taken out of the canal in Saint James's Park." In size it was about $\frac{1}{10}$th of an inch long, and nearly as broad. He figures another, considerably smaller, taken from the banstickle or prickleback; and as it differed from the former slightly in shape as well as size, he concludes that they were distinct species. The one he calls the "Louse of the Carp," the other, the "Louse of the Banstickle or Prickleback." Long previous to this, however, Leonard Baldner, an intelligent fisherman belonging to Strasbourg, had noticed a species of Argulus infesting the fishes in the neighbourhood of that town.

In a manuscript, which bears the date of 1666, entitled "a description of the birds, fishes, and insects, found in the neighbourhood of Strasbourg," written in German, a copy of which is now in the Library of the University there, he speaks of this little creature under the name of "Pou de poissons." Hermann informs us that his father had consulted the original manuscript written by Baldner himself; and which appears, from the account given of it by Herissant, in the 'Bibliothèque physique de la France,' No. 1180, to have been presented to M. Spielmann, Professor of Medicine in Strasbourg, by the relatives of Baldner, citizens of that town. It was very difficult to be read, but it contained many excellent observations. Several copies, written by different and more legible hands, seem to have existed, for Mr. Willughby must have had one, as he quotes from it repeatedly in his works on Birds and Fishes; and another copy exists at Mayence. M. Hermann thought so highly of it, that it was at one time his intention to have published it, but his death prevented this design being carried into execution. Frisch, in his 'Insecten in Deutschland,' tom. vi, published in 1740, gives a very imperfect figure of an Argulus, and describes it shortly under the name of "Fisch-laus." Loefling, in the 'Act. Soc. reg. Scient. Upsal,' 1751, describes the same animal at greater length, under the name of "Monoculus cauda foliacea plana;" but though he has entered more minutely into the details of its organization than his predecessors, his accompanying figures are very indifferent. "It is found," he says, "upon the Pike and Perch, and is called by the natives of Sweden, where his specimens were taken, the *Abbor-lus* and *Gådd-lus*."

Linnæus, in the tenth edition of his 'Systema Naturæ,' 1758, and again in his 'Fauna Suecica,' 2d edit. 1761. notices the Argulus under the name of *Monoculus foliaceus*, In the 12th edition of the 'Systema,' 1767, he unfortunately, however, confounds it with the Caligus, under the name of *Monoculus piscinus*. Under this name he refers to the Argulus, as described by himself, in his two last-mentioned works, and by Loefling; to the Caligus, as described by Baster, in his 'Opuscula Subseciva;' and to the Prosopistoma, figured by Geoffroy, in his 'Insectes de Paris.' Fabricius, in his 'Systema Entomologiæ,' 1775, and Gmelin, in the 13th edition of the 'Systema Naturæ,' repeat this error, giving the species *Monoculus piscinus*, with all the faulty synonyma. Geoffroy, in his 'Insectes de Paris,' 1762, observing that this, and some other species of Entomostraca, had two eyes, formed the genus Binoculus to receive them. This little parasite he had once found upon the stickleback; but not having time to examine it attentively, he has given no lengthened description, merely noticing it under the name of *Binoculus gasterostei*."*

Ledermüller, in his 'Amusements microscopiques,' part i, 1764, has given a figure of the Argulus, and describes it as "a small aquatic insect," which he thought worthy of attentive consideration. His figure is enormously magnified, and very indifferent. Müller is the first author who has given it the name of Argulus. In his 'Entomostraca,' 1785, he established the genus Argulus, and described two species, indicating, besides, a third. The last is a very doubtful species, while the two first are the same, the only difference being in age, Müller erroneously considering the young animal as distinct from the adult.

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* The second species of his genus Binoculus he calls *Binoculus hæmisphæricus*, and gives as synonyms the references of Frisch, Loefling, and Linnæus (10th edit.), to the genus Argulus. An examination of the figure accompanying the description distinctly shows, however, that this is a totally different animal, being the Prosopistoma of Latreille.

Fabricius, in his 'Entomologia Systematica,' 1793, introduces a species amongst his Monoculi, under the name of *Monoc. Argulus;* but though he quotes the *Argulus delphini* of Müller as being the animal he alludes to, his description of the species, which he gives at considerable length, is totally different from that of Müller, or any other author.

Cuvier, in his 'Tableau élément. de l'Hist. Nat.,' 1798, mentions the Argulus under the name of *Monoculus gyrini*, or "Pou de têtard," having found it upon the tadpole of the common frog. The same celebrated author read, at one of the early meetings of the Philomathic Society, a paper containing a number of excellent observations upon the anatomy and physiology of the same creature, under Geoffroy's name of "le binocle de gasteroste." For the contents of this paper we are indebted to M. Latreille, who, in his 'Hist. Nat. Crust.,' 1802, describes the species of insect mentioned by Cuvier under the name of *Ozolus gasterostei*, retaining the generic name of Argulus for the species erroneously described by Müller from the young individual. In his later publications, however, he cancels the genus; in the 'Genera Crust. et Ins.,' 1806, referring it to the genus Binoculus of Geoffroy, and in the 'Règne Animal,' 1829, adopting Müller's name of Argulus.

Hermann fils, in his 'Mémoire aptérologique,' 1804, has made a good many observations upon this little creature, and given two tolerably good figures of it. The most elaborate description, however, that has been given is by Jurine fils, in the 'Ann. Mus. d'Hist. Nat.' 1806. In a very lengthened memoir he has given a complete history of what had been known previous to his time, and followed that up by most careful dissections and patient observations as to its habits and nature. The memoir is accompanied with excellent figures, and indeed leaves little to be done by future labourers in the field but to corroborate his statements. Hitherto all the descriptions of and observations made by different naturalists upon the Argulus referred to one species, which seems pretty generally diffused over Europe.

In 1837 Messrs. Herrick and Dana described another species in the 'American Journal of Science and Arts' for that year. It was found in Mill River, Whitneyville, preying upon the fish called the Sucker, a species of Catostomus. The description of this species was accompanied with most elaborate anatomical details, and illustrated with numerous good figures. They gave a very accurate description also of the young or imperfect animal. Various other notices of the Argulus have been published since that. A short account of the common species was inserted by Mr. Thompson, of Belfast, in the 'Annals and Magazine of Natural History' for 1839, vol. v, with a very interesting account of the habits of the little creature, as observed by himself in an individual taken alive at Belfast, and kept by him for some time; and in the 'Memoirs of the Helvetic Society' for 1845, M. Vogt has given some very interesting details of the same species, with good figures, illustrative of some parts of its anatomy. A third species has been described by Mr. Gould, in his 'Invertebrata of New York,' under the name of *Argulus alosæ*, and more recently, a fourth species has been added to the list by M. Lucas. It was found by him in Algeria, and is figured in the recent 'Exploration scientifique de l'Algérie.'

Anatomy and Physiology, &c.—The body of the Argulus is covered by a carapace of a greenish hue, and nearly transparent. It is slightly convex, obtusely rounded in front, and deeply notched behind. This deep notch is occupied by the thorax, which at first sight almost escapes observation, the animal apparently having the cephalothoracic portion of the body covered altogether by the broad carapace. This may be divided into three parts. The first, or anterior, is rounded in front, and prolonged behind, terminating in a blunt point. The other two, the posterior portions, are of an oval form, and cover the lateral parts of the animal. They arise towards the middle of the body, and extend downwards, covering a portion of the thorax. The line of separation between these lateral lobes and the anterior division is very distinctly to be seen, forming a mark like the letter V. In the anterior portion we see the eyes and the brain shining distinctly through the shell, and in the latero-posterior portions we trace a highly-coloured series of ramifications, springing from a trunk which comes direct from the stomach.

The eyes are lodged in the thickness of the shell, and appear as two dark spots placed at a little distance from each other. They are situated on the upper part of the anterior portion of the carapace, are immoveable, of a spherical form, and of a very deep violet colour. Each eye is inclosed in a membranous sac, and, like the eyes of the Branchiopodæ, are areolar.

The brain appears in form of a small black point, situate behind the eyes, and consists of three lobes, of about equal size. Nerves are given off from this mass, which may be seen running down, to supply the abdomen and natatory legs.

The antennæ (t. XXXI, f. *a*) are situated in front of the eyes, and are completely concealed under the anterior edge of the carapace. They are short and stout, consisting of two joints. The basilar joint is broad ; the terminal equally broad at the base, gradually tapers to a point, and terminates in a curved horn-like point. This joint has, on its external edge, a slender appendage, three-jointed, directed outwards, and extending beyond the branch from which it springs. Arising close to the base of these antennæ we find a pair of organs (t. XXXI, f. *b*), which have been described by Jurine, and Dana and Herrick, as a second pair of antennæ. They are smaller than the antennæ, and consist of four articulations. The basilar joint is large, and the other three gradually become smaller and smaller, the apical one terminating in three or four very small spines. The anterior pair of these organs is described by Cuvier as the mandibles. Jurine considers them as organs by means of which they assist the animal to fix itself to its prey. Ledermüller describes them as antennæ, and since his time, Dana and Herrick, and M. Edwards, have shown them to be the true antennæ of the animal; while, according to the latter author, the posterior pair of organs are the first pair of foot-jaws.

The organs of the mouth are of a complex nature. The most prominent part is a long, sharp-pointed siphonal tube (t. XXXI, f. *d*, *c*). It arises at a considerable distance behind the antennæ, and is formed of a very fine tube, inclosed in a flexible sheath. The extremity terminates in a very sharp point, at the top of which we see the orifice of a canal, hollowed out of the interior, which is prolonged to the commencement of the œsophagus. It is moveable, the animal being able to thrust it out rapidly from its sheath, carry it right or left, and project it far enough to reach the anterior edge of its shell. It can also cause it to enter into its sheath with the same rapidity by means of a slender muscle, which at one part is attached to the base of the sheath, and at the other to the middle of the trunk. The sheath is nothing but a prolongation of the lip, while the sharp-pointed portion constitutes the analogue of the mandible. Below the insertion of this siphon we see a convex, oval mass (f. *d*), containing the rest of the apparatus of the mouth. According to Dana and Herrick, who have described this part with great care, these consist of what is perhaps the inferior lip, and two pairs of maxillæ in a rudimentary state. These authors consider that Jurine, who describes the convex, oval mass mentioned above as the heart, is quite mistaken; and that the motion which he considered the palpitation of the heart, is nothing but the rapid motion of the maxillæ.

The feet of the Argulus are generally described as of two different kinds: one used either for walking with or fixing itself upon its prey; the other adapted for swimming when the animal is at large. What have been called the ambulatory legs are two pairs in number. They are the second and third pairs of foot-jaws. The anterior pair, or second pair of foot-jaws, (t. XXXI, f. *e*, *f*) is of a very peculiar construction. They are in the form of short, hollow, flexible cylinders; the pedicle by which they are attached to the animal being thick and muscular, and the extremity terminating in a broad, circular, horizontal rim, almost cartilaginous, having a membranous margin, fringed all round with numerous rays, which, according to Dana and Herrick, are many-jointed. Four muscles are attached to the base of each of these organs, and extend up the sides. By this organization the animal can make use of them as real *suckers*, or cupping-glasses, to fasten itself to the fish upon which it lives, and also to walk with, when it wishes to change its position. By contracting these muscles, it can exhaust the cavity of the sucking-disc, producing a vacuum, and thus enabling it to adhere firmly to the surface upon which it is placed. When it wishes to change its place, it relaxes the muscles first of one sucker, carrying *it* forwards, and then the other, alternately, as was long ago observed by Loefling. The second pair of ambulatory legs, or third pair of foot-jaws (t. XXXI, f. *g*), arises immediately below these suckers, and is very different in conformation. They are somewhat cylindrical, and are composed of five articulations. The first two are much larger than the others, have their surface roughened with small spines; and at the base of the first joint, we see three strong teeth. The last joint gives off at its extremity two small hooks. These organs are called the prehensile feet by Dana and Herrick, and no doubt they do assist the animal to secure itself more firmly in its position. The natatory feet are four pairs, arising in a series on each side of the thorax, and partly covered by the lateral portions of the carapace. The first three pairs (t. XXXI, f. *h*, *i*,) consist each of a large fleshy peduncle, or basilar portion, which is obscurely divided into two joints, and gives off at its extremity two long branches, beautifully fringed, with transparent and delicately plumose cilia; while a third shorter branch, equally plumose, arises from the base of the two preceding, and is curved backwards and inwards. The fourth pair (t. XXXI, f. *k*, *l*) is destitute of this recurved branch; but it is otherwise formed like the three preceding.

The thorax has been described above as occupying the deep notch observable in the carapace. Immediately behind the suckers it becomes distinct from the head. It consists of four separate joints, from each of which arises a pair of the feet just described, and traces of a fifth are indistinctly visible.

The abdomen, as in all the Siphonostoma, is very small. Most authors have described it under the name of tail, considering the thorax to be the abdomen. It consists of a broad plate, which at the base is bilobed, and carries, close to where the separation commences, a pair of rudimentary organs of an oval form, and ciliated on the margins.

In the female we see, at the base of each of these lobes, a small black, spherical body, which does not occur in the male.

The intestinal canal commences at the base of the siphonal tube, and extends to the bifurcation of the abdomen, where it terminates by the anus.

Upon viewing the little animal from above, we observe very distinctly, as has been already mentioned, a ramification of opaque tubes running through the lateral portions of the carapace (t. XXXI, f. 2). They arise from a single branch which springs from the stomach, and extends on each side to near the edge of the shell.

The stomach, or commencement of the alimentary canal, is of considerable size, and of an oval form; and these ramifications are considered by Jurine as the intestines. Inferiorly the stomach narrows into a pyloric termination, which opens into a kind of cæcum, having two appendages springing from its anterior part. This again contracts into the rectum, which descends to the bifurcation of the abdomen, and there opens by an oval orifice situated in the centre of the bifurcation.

The female Argulus differs from all the other Siphonostoma in not having like them external oviferous sacs. The matrix is contained in the thoracic portion of the body, and in a gravid female the whole cavity of the thorax is occupied with the eggs. These escape by a very short oviduct, whose orifice is placed between the two natatory feet.

The male organs have been described by Jurine, and he appears to have been the first to detect them; indeed they have not been described by any other individual. According to this author, they are situate on the last two pairs of feet. On the anterior edge of the first joint of the fourth pair, and close to its extremity, there is a brown conical tubercle of a horny nature, the base of which is armed with a small hook directed backwards. Corresponding to this, we find on the posterior edge of the first ring of the preceding, or third pair of feet, a vesicle filled with transparent liquid; apparently, says Jurine, destined for fecundation. The male organs are thus double. The circulation of the blood can be distinctly seen in several parts of the body. The blood is a transparent fluid, composed of small, round, diaphanous globules, and is propelled to the different parts of the body by distinct pulsations, which occur about once every second.

The Argulus in this country is found upon various fresh-water fishes. In the neighbourhood of London it is most commonly to be met with upon the stickleback; but it has been taken also upon the carp and the roach; and in other places it has been found upon the trout, the pike, the perch, and even upon the tadpole of the common frog.

An individual taken from the salmon trout at Belfast, by Mr. W. Thompson, was placed by him in water in which salt was dissolved, till it became to the taste like sea-water, and it remained for four or five hours active and lively.

The species which has been described by Dana and Herrick, in North America, was taken from the fish called the Sucker, in the water of Mill River, near Whitneyville, into which the tide from Newhaven Harbour enters, and renders, consequently, brackish, so that it would appear this little animal, though in reality a fresh-water species, is not injured by an admixture of salt.

The *Argulus foliaceus* is an exceedingly pretty and graceful little animal; and as it can leave the fish upon which it feeds, and swim freely in the water, there are many opportunities for watching its gambols through its native element. It generally swims in a straight line, but it frequently suddenly changes its direction, and often turns over and over several times in succession.

Ledermüller says he has seen an individual turn over thus a hundred times in a minute, and that it swam afterwards with such velocity, sometimes skimming the surface, at others plunging deeper in the water, that he could scarce follow its motions with his eye. Sometimes it will attach itself to the side of the vessel in which it is kept; and we may then observe that though, as far as progressive motion is concerned, the little creature is at rest, the natatory feet are in constant motion. Like those of the Branchiopoda, they serve the animal not only for swimming with, but also for respiration. Their structure is precisely similar, and their use the same. When swimming free in the water, and wishing again to fasten itself to its prey, the little animal approaches a fish, quietly allows itself to be hurried along in the current caused by its motion through the water, till it touches it, when it immediately fastens itself to it, choosing, according to Jurine, as its place of residence the under part of the pectoral fins.

Loefling states that the part where the *Argulus foliaceus* is chiefly found is within the gills, or immediately outside; and Dana and Herrick inform us that their *Argulus Catostomi* was *always* found within the branchial cavities; but when the fish itself was immersed in fresh water the parasite forsook the gills, and, after swimming about for some time, would often attach itself to the anterior part of the body.

Jurine observed that the fishes seemed to be afraid of the little intruder, and that however eager after food they might be, they would never willingly touch an Argulus; and that if by chance a fish should swallow one, it would almost immediately afterwards be rejected.

The males are always considerably smaller than the females; and appear, especially in summer, very ardent in pursuit of them. They course up and down over the whole surface of the fish in search of a mate, and should they not succeed in meeting any, they leave their habitation, and go elsewhere seeking for one. When they succeed, the male mounts upon the female's back, and carrying his body laterally he crosses that of the female, embracing her at the same time with his natatory feet. This copulation frequently endures for several hours, and during that time they adhere so closely, that they cannot be separated without considerable difficulty. In the unimpregnated female the matrix is very small; but soon after fecundation it begins to increase in size, and in a short time it occupies almost the whole cavity of the thorax. The number of eggs is very considerable, in the *Argulus foliaceus* amounting sometimes to 400; in the *Argulus Catostomi* upwards of 1500 have been seen deposited by one female. They carry their eggs for a period between thirteen and nineteen days; and then, when the female is ready to spawn, she detaches herself from the fish, upon which she has been living, and seeks a suitable place to deposit them. This is either upon a stone or some solid body, and as she lays them, she glues them together, so that they might be all taken up in a mass. They are laid side by side in rows, and are at first of an oval form and of a white colour. They soon after become of a dirty yellow, and thirty-five days after being laid, the young are hatched. In form they resemble a good deal the adult, but differ considerably in construction and development of their organs. Deceived by this, Müller forms of the imperfect young a distinct species,—an error which Jurine has pointed out. The shape is oval, or somewhat pyriform, and the eyes and siphon are perfectly formed.

The natatory feet are very imperfectly developed; their function being supplied by two pairs of organs in form of rami, placed on the anterior part of the body. The first pair corresponds with the antenna in the perfect animal; the antenna itself being well developed, and the appendage which projects from its posterior edge being enlarged into this long ramus, constituting the chief part of the organ. The second pair corresponds with the first pair of foot-jaws in the adult. These organs are large, consisting of several articulations, the terminal one of which gives off several long setæ. By means of these rami the little creature moves with ease by bounds, like the Daphnia. The sucking-discs are not yet formed, their place being supplied by a pair of large feet, broad at their base, and terminating in a prehensile hook, by means of which the animal can fix itself upon its prey. The organs immediately following these are only slightly developed, and correspond with the third pair of foot-jaws, and the natatory feet are little more than rudimentary. In this state the young animal continues for about six days, when it casts its shell. Three days after the first moult, it changes its shell again; and two days after that a third moult takes place. By this time we find the rami have disappeared, the natatory legs have become developed, and the sucking-discs have assumed somewhat of their shape and appearance.

Two days after this the fourth change of shell takes place, when the sucking-disc has become perfect. Six days later, the fifth moult occurs, when the sexual organs make their appearance; and after the sixth change, which takes place six days subsequently, or twenty-five days from their being hatched, the animals commence to breed. They have now, however, only attained half their full growth, but gradually augment in size after successive moults, which take place every six or seven days.

An experiment conducted by Jurine, and fully detailed by him, tends to prove that the Arguli do not, like some of the Branchiopoda, become pregnant without the intervention of males. He isolated six young females immediately after birth. They underwent their usual changes of shell, till the time when the sexual organs became fully developed; but though kept for some time, no appearance of impregnation took place. To one of these he gave a male; copulation took place, and the animal became pregnant. The other five remained unimpregnated, and all died of a peculiar disease, without having shown even the slightest appearance of ova.

1. Argulus foliaceus. Tab. XXXI, figs. 1, 2.

Monoculus foliaceus, *Linnæus,* Syst. Nat., edit. 10th, i, 634, No. 2, 1758; Faun. Suec., edit. 2d.
Argulus foliaceus, *Jurine fils,* Ann. Mus. d'Hist. Nat., vii, 431, t. 26, 1806.
— *Leach,* Dict. des Sc. Nat., xiv, 529.
— *Lamarck,* Hist. Anim. s. Vert., v, 207.
— *Latreille,* Règne Animal, iv, 195.
— *Desmarest,* Consid. gén. sur les Crust., 331, t. 50, f. 1.
— *Guerin,* Iconog. Règne Anim. Crust., t. 35, f. 1.
— *Burmeister,* Nov. Act., xvii, 332.
— *M. Edwards,* Hist. Nat. Crust., iii, 444; Règne Anim., édit. Crochart, t. 78, f. 1.
— *Thompson,* Ann. Nat. Hist., v, 221.
— *Garner,* Nat. Hist. of Staffordshire.
— *Bosc,* Man. d'Hist. Nat. Crust., ii, 220.
— *Kroyer,* Tidsskrift, vol. i, pp. 190-203.
— *Vogt,* Nouv. Mém. Soc. Helvét., vii, t. 1, f. 2.
Argulus delphinus, *Müller,* Entomost., 123, 1785.
— *Hermann,* Mém. Apterol., t. 5, f. 3, and t. 6, f. 11.
— *Latreille,* Enc. méth., t. 334, f. 1-22, art. Argulus, p. 100.
Argulus charon, *Müller,* Entomost., t. 20, f. 1, 2.
— *Latreille,* Encycl. méthod, l. c.
Argulus argulus, *Leach,* Edin. Encyclop., 1814, vii, p. 388, art. Crustaceology.
Monoculus delphinus, *Gmelin,* Syst. Nat., edit. 13th, 1788.
— *Manuel,* Encyc. méth., vii, 730.
Monoculus argulus, *Fabricius,* Ent. Syst., ii, 489, 1793.
Monoculus gyrini, *Cuvier,* Tab. élément., 454, 1798.

Binoculus gasterostei, *Geoffroy*, Ins. de Paris, ii, 661, 1762.
— *Latreille*, Gen. Crustac. et Ins., i, 14.
Ozolus gasterostei, *Latreille*, Hist. Nat. Crust. et Ins., iv, 128, t. 29, f. 4, 1802; Dict. d'Hist. Nat.
Louse of the carp, *Baker*, Employm. for Microsc., 374, t. 14, f. 14.
Louse of the banstickle, *Baker*, l. c., 376, t. 14, f. 15.
Petit insecte aquatique, *Ledermüller*, Amus. Micros., part i, 76, t. 37.
Monoculus cauda foliacea plana, *Loefling*, Act. Soc. Reg. Scient. Upsal, t. 2, f. a-d.
Fisch-laus, *Frisch*, Insect. in Deutsch., vi, t. 10, f. *a*.
Monoculus cyprinaceus, *Shaw*, Naturalist's Miscellany, xviii, t. 736.

Description.—The *Argulus foliaceus* is of a rounded, oval shape, the front of the carapace notched on either side, and bluntly projecting in the centre. It is nearly transparent, of a slightly greenish hue, and elegantly marked on both sides by a series of ramifications of a darker colour. The female is larger than the male, and is distinguished, in addition to the ovaries, by a black mark on each lobe of the abdomen. The last pair of feet is not concealed by the carapace.

Hab.—On the carp and banstickle, St. James's Park, Baker. Trout (*Salmo fario*) and pike (*Esox lucius*), W. Yarrell, Esq., J. Doubleday, Esq. Salmon-trout, Belfast, W. Thompson, Esq. Stickleback, Highgate Ponds, Hammersmith, &c., W. B.

Family—CALIGIDÆ.

Caligidæ, *M. Edwards*, Hist. Nat. Crust., iii.
— *Baird*, Trans. Berw. Nat. Club, ii.
Caligidæ (*pars*), *Leach*, Dict. Sc. Nat., xiv.
— *Risso*, Hist. Nat. Eur. Merid., v, 134.
— *Desmarest*, Cons. gén. Crust., 334.
Caligina (*pars*), *Kroyer*, Tidsskrift, i, 200 (?).
— *Burmeister*, Beitr. zur Naturg. der Rankenfuss., p. 54, 55 (?).
— *Dana*, Proc. Amer. Acad. Arts and Sc., 1849, p. 54.

Character.—Head in form of a large buckler, having anteriorly large frontal plates. Four pairs of feet, which are furnished with long plumose hairs. Antennæ small, flat, and two-jointed. Second pair of foot-jaws of two articulations, and not in form of a sucking disc. Thoracic segments uncovered.

Bibliographical History.—Linnæus seems to be the first author who takes notice of any animal belonging to the genus Caligus. In his 'Fauna Suecica,' second edition, 1761, he shortly describes a species which lives upon the salmon and haddock, inhabiting the Norwegian seas. He designates it "*Monoculus piscinus*," and quotes Martin as his authority for the habitat. In the same work he describes a species of Pediculus, which is found upon the salmon also, calling it the "*Pediculus Farionis*." From the general description of this little creature, and more especially from its possessing two long ovarian tubes, it is evident that it is a species of Caligus, and from its being found upon the same species of fish, it would appear to be closely allied to the *Monoculus piscinus*. In his 'Systema Naturæ,' 12th edition, 1767, he, indeed, distinctly affirms this, and says it is "allied to the *Monoculus piscinus* from its having two cylindrical bodies placed above the tail;" and Gmelin, in his edition of 1788, under the species "*Pediculus Farionis*," remarks, "that it scarcely belongs to this genus." Ström, in his 'Physiske og Oeconomisk Beskrivelse over Fogderiet Sondmor,' 1762, describes and figures what may be two species of Caligus, but which are perhaps only the male and female, under the name of *Fiske luus*, or *Pediculi marini*; and Baster, in his 'Opuscula Subseciva,' 1765, describes and figures also two or three different species of this genus, accompanied with considerable details. Both of these authors represent the animal with its head downwards, and considered the two long ovarian tubes as antennæ, mistaking the tail for the head. These figures and descriptions appear to have misled Linnæus; for, notwithstanding his having already described the animal correctly in his 'Fauna Suecica,' he subsequently, in the 12th edition of his 'Systema Naturæ,' 1767, describes the *Monoculus piscinus* as consisting of two kinds, differing either in sex or species, the one having *two antennæ longer than the body*, and the other having none. Ström again, in the 'Skrifter Kiobenhavnske Selskab,' 1770, describes and figures another species, and evidently a second time mistakes the tail for the head.

In describing the Argulus, I have mentioned that Linnæus, in his twelfth edition of the 'Syst. Nat.,' confounded that animal with the Caligus. In the 'Fauna Suecica' he described them as separate species; but in this latter work he not only quotes his own previous description of the Argulus as a synonym for the Caligus, but he even refers to Loefling's figure of that animal as further evidence of their identity. This erroneous synonymy is repeated by Fabricius, in his 'Systema Entomologiæ,' 1775, and by Gmelin, in his edition of the 'Systema Naturæ,' 1788. Slabber, however, previous to Gmelin's edition, in his 'Naturkundige verlustigingen,' 1778, had given a figure, under the name of *Oniscus lutosus,* of a species belonging to this family, and delineated the true antennæ and some other parts very correctly.

O. Fabricius and Herbst seem also to have better understood the anatomy of the animals belonging to this group. The species which they have described, the former in the 'Fauna Grœnlandica,' 1780, and the latter in the 'Berlin Gesellschaft Skrifter,' 1780 and 1782, are accompanied, especially the latter, with a number of details, and are pretty accurately described by both. Müller, in his 'Prodrom. Zoologiæ Danicæ,' 1776, introduces the genus under the name of "Binoculus," adopting that name from Geoffroy; but in his 'Entomostraca,' 1785, he founds the genus Caligus. Hitherto no zoologist had clearly ascertained the situation of the eyes, and it was from this apparent blindness that the generic name was suggested to him. With regard to their exact situation, however, even he was deceived, for though he really saw the true eyes, he yet did not consider them to be such, but absolutely mistook a different part altogether. Notwithstanding this, his description of the genus and the two species which he gives is better than any that had as yet appeared.

Geoffroy described and figured, in his 'Insectes de Paris,' 1764, a small crustacean, under the name of *Binoculus hæmisphæricus*. It bears some resemblance to a Caligus, and Linnæus, in the 'Syst. Nat.,' twelfth edition, quotes it as a synonym for his *Monoc. piscinus*. This is repeated by Fabricius, in his work already quoted, 'Entomologia Systematica,' 1793, and in the Supplement to the work, 1798. It is not, however, a Caligus, but a different genus altogether, to which Latreille has given the name of Prosopistoma. Manuel, in the 'Encyclopédie méthod.,' 1792, avoids this faulty reference, but falls into the error of his predecessors with regard to the Argulus.

Cuvier mentions the *Calygus* in his 'Tableau élémentaire,' 1798; and Latreille, in his 'Hist. Nat. Crust. et Ins.,' 1802, presents us with a lengthened account of the genus, giving all the details made known to us previously by Müller and others. Risso, in his 'Hist. Nat. des Crust. des Envir. de Nice,' 1816, and in his 'Hist. Nat. de l'Europe mérid.,' 1826, mentions several species belonging to the Caligidæ; Tilesius, in a paper in the 'Mém. de l'Acad. Imp. des Scien. de St. Pétersbourg,' 1815, details at some length Müller's two species, and adds some interesting notices of a number of creatures allied to this family, as connected with the luminosity of the sea; and Lamarck, in the first edition of his 'Hist. Nat. des Anim. sans Vertèb.,' 1818, describes shortly the few species previously made known to us. Amidst this host of continental authors, no British zoologist appears, with the exception of Dr. Leach. In his article "Crustaceology," in the 'Edinburgh Encyclopædia,' 1814; in his article "Annulosa," in the Supplement to the 'Encyc. Britann.,' 1816; and still later, in the article "Entomostraca," in the 'Dict. des Scien. Nat.,' 1819, he describes the genus, and introduces, apparently for the first time, a British species.

Of late years, much more has been done by the continental zoologists to extend our knowledge of these curious little creatures. Otto, in the 'Nova Acta Natur. Curios.,' 1828, Burmeister, in the same work for 1831, Kroyer, in his 'Tidsskrift,' 1838-9, and M. Edwards, in the 'Ann. des Scien. Nat.,' 1833, and in his 'Hist. Nat. des Crust.,' 1840, have given us a great deal of extremely interesting information with regard to their habits, extended our knowledge as to the number of species, and brought forward a variety of startling facts respecting the young, and the curious changes of form they undergo in their advance to maturity. In America, Pickering and Dana have studied carefully a species found abundantly on the common cod-fish of their coast; and in a lengthened memoir in the 'American Journal of Science' for 1838, have given a most minute description of it, with abundant anatomical details. They do not appear to have followed up the hatching of the young animals; but Mr. H. Goodsir, in a paper in the 'Edin. Philos. Journal' for 1842, has contributed somewhat to our knowledge concerning the young of the common species found in Scotland.

Anatomy and Physiology, &c.—The Caligi are generally of a more or less oval shape, and depressed. The body of the animal consists of two principal portions. The anterior, frequently much the larger, consists of an oval, shield-shaped carapace or buckler, which includes the head and greater portion of the thorax. The posterior, sometimes not a fourth part the size of the other, comprises the remainder of the thorax and abdomen.

The anterior or cephalo-thoracic portion is formed of a flexible coriaceous substance, usually transparent, and composed, according to Pickering and Dana, of two coats. On its fore part, which is obtusely rounded, we perceive a narrow plate, notched in the centre, and its posterior portion has generally a deep sinus on each margin. The dorsal surface is marked by several lines or furrows, which divide it into four distinct portions. These furrows are considered by some authors* as imperfect articulations. One on each side extends from the notch at the termination of the narrow frontal plate to the sinus at the posterior part of the carapace, dividing it into two lateral segments, while a third runs across the centre of the body, connecting the other two, and forming an upper and a lower central segment. The upper, or anterior, may be called the cephalic, and the lower the thoracic region of the carapace. The former contains, attached to it, the antennæ, eyes, organs of mouth, and foot-jaws; the latter the first three pairs of natatory feet.

The narrow plate, mentioned above as visible on the anterior edge of the carapace, is sometimes very distinct, and is prolonged laterally to a somewhat sharp point, which is detached from the margin of the carapace, and covers the insertion of the antennæ. In tracing the parts of these little creatures analogous to the parts belonging to the higher Crustacea, we might consider this plate, with its lateral prolongations, as the representative of the first pair of antennæ, here reduced to a single joint, and immoveably fixed to the carapace.

The real antennæ, (t. XXXIV, f. 5 *b*), corresponding to the second pair in the higher orders, are very short, and composed of two joints. The basal joint is inserted upon the edge of the carapace, immediately beneath the terminal point of the frontal plate. It is flattened in shape, and the upper edge is beset with short setæ. The apical joint is narrow, nearly cylindrical in form, about two thirds of the length of the preceding, and is terminated by several short hairs. In many of the species we perceive, on the frontal plate, near its free extremity on each side, and on the inferior surface, a remarkable organ (t. XXXIV, f. 5 *a*), consisting of a thin, nearly circular membrane, attached by its central portions, and in form of a cup, approaching somewhat in appearance to the sucking-disc of the Argulus. These were considered by Müller as the eyes of the animal. Later authors have proved this opinion to be erroneous, and Pickering and Dana consider them as true sucking-discs, by which the Caligi attach themselves to the fishes upon which they live. They assert, in proof of the correctness of this opinion, that they have frequently tested the use of these organs by applying the blade of a knife to the inferior surface of the front margin, while the animal was on its back, and that in numerous instances it adhered so firmly to the knife, that it was lifted up and carried to some distance. It exists, however, only in some of the species, and its presence or absence has been used by Nordmann as a generic character.

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* Pickering and Dana, loc. cit.

The eyes are two in number, and are situated nearly in the centre of the cephalic segment. They are small, simple in structure, of an oval shape, and placed close to each other. In the living animal they are of a red colour, and are slightly projecting.

The mouth (t. XXXIV, f. 5 *f*) is situated in the median portion of this segment, the eyes being placed directly over part of it. As in the Argulus, this organ consists of a siphon, or conical sucking-tube, composed of two long, slender, styliform organs, curved inwards, and armed on their points with about twelve teeth. These represent the mandibles, and they are inclosed in a sort of sheath, formed from the union of the parts corresponding to the upper and lower lip. Situated upon the sides of the sucking-tube we perceive two pairs of rudimentary appendages (t. XXXIV, f. 5 *d*). The one, rising in front of the other, consists of a small basilar joint, terminated by a short, curved apex; the other is more developed, and is divided into two stout, terminating claws, directed downwards. These constitute the analogues of the two pairs of jaws in the other orders of Crustacea.*

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* For a fuller exposition of this subject, see the very interesting memoir of M. Edwards upon the Organization of the Mouth of the Siphonostoma, as exemplified by him in the *Pandarus alatus*, in the 'Ann. des Sc. Nat.,' xxviii, 78.

The parts corresponding to the foot-jaws are well developed. They are three pairs. The first pair (t. XXXIV, f. 5 *c*)—the posterior antennæ of Kroyer—is situate between the siphon and antennæ, and consists of two articulations; the basal broad and fleshy, the terminal tapering to the extremity, which is in form of a strong hook. At a little distance from, and external to, the extremity of this joint, we see a stout, horny-looking, hooked spine, springing from it. The second pair (t. XXXIV, f. 5 *h*) is longer than the preceding, and consists of two articulations; the basal more slender than that of the first pair, and the terminal still more so, of considerable length, and ending in two or three falciform claws, the edges of which are armed with small teeth. The third pair (t. XXXIV, f. 5 *i*) is longer than the two preceding, though not so long as the second. It is cheliform, and differs a little in the two sexes. In the male, it consists of a large, fleshy, basal joint, which has articulated to it a stout claw, curved inwards, and having a small seta near its apex. In the female, the basal joint is smaller, and less fleshy, and the terminal is longer and larger than in the male. These foot-jaws constitute real organs of prehension, and it is by means of them that the animal fastens itself upon its prey.

The true feet, or natatory feet, consist of four pairs, three of which are attached to the thoracic segment of the carapace, while the fourth springs from the penultimate ring of the thorax. The first pair (t. XXXIV, f. 5 *k*) has three articulations. The basal joint is of a cylindrical form, and the second is similar in size and form, but with numerous very short setæ on under margin. The third, or terminal, is about one half the size of the others, and has on its inferior edge three long, finely-ciliated setæ, nearly as long as the preceding joint of the leg, and at the apex four short, stout, naked setæ. The second pair (t. XXXIV, f. 5 *l*) is composed of two basilar joints, the first short, and provided with a long ciliated seta on its under surface; the second very large, becoming broader from base to apex, and giving off two branches or rami, each of three joints, provided with rather long, plumose setæ. The first and second of these joints have each one very long seta springing from their base, and the terminal giving off at its apex six of nearly equal length. The third pair (t. XXXIV, f. 5 *m*) is not unlike the preceding. The basilar portion, however, seems to consist of only one joint, which appears to constitute a lamellar appendage to the lower part of the cephalo-thoracic portion of the body. It gives off two short rami, each single-jointed, and furnished with plumose setæ. On the edge of the lower part of this portion of the body there is a short spine or hook, similar to that observed near the first pair of foot-jaws. The fourth pair (t. XXXIV, f. 5 *n*) springs from the posterior thoracic segment of the body, and is very different from the preceding pairs, being more adapted for the purpose of walking than swimming. It is slender, elongated, and directed outwards; consists of four joints, and is simple, and not branched. The joints diminish in size as they approach the apex, which is either in form of a long, curved seta, with a row of short spines on its inner edge, or a short joint terminating in three short setæ. On the median line of the body, between the last pair of foot-jaws and first pair of feet, we observe a broadish appendage (t. XXXIV, f. 5 *j*), of a horny nature, generally bifurcated, directed backwards, and capable of being elevated or depressed. It is a sort of sternum. On the median line of last thoracic segment of the body, and toward the posterior extremity, we see two somewhat similar smaller horny tubercles, which M. Edwards considers may be regarded as the vestiges of a fifth pair of feet. From the external portion of the posterior part of this segment also, on each side, in the female, we see the external ovaries, two long cylindrical tubes, sometimes two or three times the length of the whole animal.

According to Pickering and Dana, the internal organs of reproduction consist of a large pyriform organ, of a glandular appearance, situate just anterior to the stomach, and provided with a duct which extends through the whole length of the thorax, and terminates, in the female, in the ovarian tubes; and in the male, in the genital organs, situated in the same place as the external ovaries in the female. They are thus analogous to the spermatic glands in the one, and the internal ovaries in the other sex.

The abdomen is generally very small, in proportion to the rest of the body. It consists of only one joint, and sends off from its posterior edge two plates, each furnished with several pretty long plumose hairs or filaments.

The intestinal canal may be easily traced through the parietes of the body, extending from the mouth through the length of the thorax and abdomen to the anus, which opens between the caudal appendages. It consists of an œsophagus, stomach, and intestine. The muscular system is well developed, and the muscles moving the different members may be easily traced through the pellucid skin.

The circulation of the blood is fully described by Pickering and Dana. It seems to be wholly lacunal, and consists of broad, irregular streams, passing through the spaces left among the internal organs. No distinct vessels have been discovered. The number of pulsations has been found to vary from thirty to forty in a minute.

The Caligi are only found upon marine fishes. They adhere to the body among the scales, by means of their foot-jaws, and can quit the place they have chosen, and move to another part of the fish. They are most frequently, perhaps, found on the parietes of the mouth and branchial cavities, but occur also indiscriminately on different portions of the body. Sometimes they occur in great numbers, on the same fish. Pickering and Dana tell us that they are found most numerous on half-grown fishes, and that they have taken as many as forty specimens from one individual. On the salmon I have observed them in considerable numbers, and on various parts of the fish. We notice both sexes on the same fish, though the females are the most abundant. Their habits are rather difficult to observe, as they generally die soon after the fish upon which they live are taken out of the water.

Pickering and Dana introduced several individuals into a glass of salt water, soon after the fish was caught, and remarked that the greater portion of them sought the surface, where they attached themselves to the sides of the glass. Many quitted the water entirely, and crept up the glass for an inch or two above the surface. In doing so, they carry a portion of water with them, confined under their broad carapace, the margin of which is closely attached to the side of the vessel, and thus are enabled to exist for some little time. They did not seem, however, to make any attempt to return to the element they had left, and died soon afterwards.

When living attached to the fish, should they be touched or disturbed, they move with considerable rapidity, and travel over the body of their host, moving along with equal facility either backwards or forwards. By means of their natatory or branchial feet, they swim also with considerable rapidity, and no doubt occasionally change from one fish to another, as Ström had long ago observed. Their food does not seem to be exactly ascertained. Ström asserts that they live by sucking the blood from the fish, and says that he has seen that fluid flow into the mouth of the Caligus, and thence through the neck and whole body.

As Müller justly remarks, however, with regard to Ström's observations, they carry little weight with them, for as he mistook the *tail* for the *head*, he must have misunderstood the nature of what he saw, and perhaps taken the genital organs for the mouth. "I cannot believe," he says, "that they suck the fishes, but it is more probable, from their moving their branchial feet, as all the rest of the Entomostraca, that they cause the water to carry to their mouth the molecules floating in it, and the mucus from the fish." O. Fabricius also says, that the species he describes nourishes itself with the mucous juices of the fish it lives upon. This opinion receives confirmation from the observations of Pickering and Dana upon the species described by them, as they have never detected any blood in the stomachs of those they have dissected, though they have frequently opened them immediately after taking them from the fish. The fluids in the intestines were always of a light colour, and they conclude that their food must consist of the mucus which covers the body of the fish, a secretion which is natural to it, and always abundant.

The Argulus and the Caligi are generally found most abundant on weak and diseased fishes. It does not follow however, from this, that the fish is rendered weak or diseased by the attacks of these parasites, but that being previously weakened by wounds or disease, it is less able to avoid them, and more incapable of clearing itself of them.

The Caligi change their skin, as well as the other Entomostraca, but respecting the process little as yet is known. Pickering and Dana, to whom I have so frequently referred, inform us, that as the time for throwing off the old skin approaches, the internal membrane, which is destined to form the new envelope, and which may in some species be seen through the outer shell, is observed to be folded variously into small ridges, over the whole body of the animal, which ridges or folds continue to increase in size as the time for moulting approaches. These folds, they remark, evidently result from the animal increasing in size, within a shell which has become too small to admit of its expansion. Nothing seems known with regard to their method of copulating. Tilesius, indeed, asserts that he has witnessed the act. He says he has seen two individuals adhering for days together, the thorax of the one fixed to the abdomen of the other. But that what he had seen was a true act of copulation is doubtful, for he attempts to prove that the *Caligus productus*, Müll. (which is now ascertained to belong to a different genus even), and the *curtus*, Müll., are the same species, the former being the female and the latter the male; and it was these two different species that he had observed, as he imagined, in the act of copulation.

Tilesius and others have doubted whether the long filaments attached to the posterior extremity of the thorax were really ovaries. This is now clearly ascertained to be the fact. They contain a great number of eggs, which are round, and disposed in one single row, and even young females are found, as is the case with other Entomostraca, to possess external ovaries filled with eggs. The young, when first hatched, are very different in appearance to the adult. In form they resemble closely the young of the Cyclopidæ, and, like them, undergo a series of changes of skin, or moultings, before they assume the completely-developed form of the parent animal.

This family contains four British genera—Caligus, Lepeoptheirus, Chalimus, and Trebius.

1. CALIGUS.—Fourth pair of feet slender, of only one branch, and serving the animal for walking. A pair of small lunules or sucking-discs on the lower surface of the frontal plates.

2. LEPEOPTHEIRUS.—Fourth pair of feet as in Caligus. Frontal plates destitute of the lunules or small sucking-discs.

3. CHALIMUS.—Feet as in two preceding genera. Frontal plate provided with a long and slender appendage adapted for prehension, arising from the centre of its anterior surface.

4. TREBIUS.—Fourth pair of feet slender, and divided into two branches, adapted for swimming. No lunules or sucking-discs on frontal plates.

Genus 1—Caligus.

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Caligus, *Müller,* Entomostraca.
— *Latreille, Cuvier, Lamarck, Leach, Desmarest, Nordmann, M. Edwards, Pickering and Dana, Kroyer, &c.*
Monoculus, *Linnæus, Fabricius, Manuel.*
Binoculus, *O. Fabricius,* Faun. Grœn.
— *Müller,* Zool. Dan. Prod.
Pediculus, *Baster,* Opusc. Subseciv.
— *Ström,* Phys. og Oeconom. Besk.
Oniscus, *Slabber.*

Character.—Fourth pair of feet slender, of only one branch, and serving the insect for walking. Thorax exhibiting only two distinct articulations. Frontal plates possessing a small sucking-disc or lunule on the under surface of each lateral portion.

1. Caligus diaphanus. Tab. XXXII, fig. 1.

Caligus diaphanus, *Nordmann,* Microgr. Beitr., ii, 26.
— *Kroyer,* Tidsskrift, i, 623, t. 6, f. 5.
— *M. Edwards,* Hist. Nat. Crust., iii, 452, No. 5.
— *Thompson,* Ann. Nat. Hist., xx, 247.
— *Baster,* Op. Subsec., ii, t. 8, f. 9 b (?).

Description.—*Male.* Carapace large, and nearly round; frontal plate of considerable size; lunules distinct but not large. Antennæ of moderate size; basal joint large, and setiferous on external edge. Thorax very much smaller than carapace. Penultimate segment very small and narrow; the last somewhat lunulate, the external posterior angles terminating in a projecting lobe, which is shortly bifurcated, the external fork giving off one, and the internal two, short plumose setæ.

Abdomen nearly as long, but narrower than the last joint of thorax, and terminating in two pretty large caudal plates, each sending off three long and one short plumose setæ. Third pair of foot-jaws very large. Sternal fork small, with simple branches. Fourth pair of feet terminating in one long curved spine or claw, serrated on its inner edge, and one or two short ones at its base. Appendages at inferior portion of last articulation of the thorax slender, simple.

Hab.—Belfast Bay, W. Thompson, Esq. Taken from the turbot in March, July, and December; from the *Trigla pini* (gurnard), the mackerel, and *Lota molva* in March and October; from the *Merlangus carbonarius* in March; the *Pagellus centrodontus* in October; and the plaice in March, October, and December; the codfish in January; and the halibut in March. British Museum.

2. CALIGUS RAPAX. Tab. XXXII, figs. 2, 3.

CALIGUS RAPAX, *M. Edwards,* Hist. Nat. Crust., iii, 453, No. 6, t. 38, f. 9.

Description.—*Female.* Carapace oval, considerably longer than broad, narrower at upper extremity, and broad posteriorly. Frontal plates prominent, and very large for the size of the animal, nearly straight in centre, or but very slightly notched. Lunules large. Antennæ also exceedingly large for the size of the animal, the basal joint broad, and armed with ten plumose hairs or setæ on its upper edge; the terminal joint long, nearly the length of the basal joint, and furnished at its extremity with five or six sharp setæ.

Thorax not quite so long as carapace, and much narrower; last joint obovate or pyriform, and slightly lobed at the posterior extremity on each side. Abdomen about two thirds the size of the thorax; longer than broad.

Caudal plates of considerable size, and terminated by three stout long, and one short, plumose setæ. Sternal fork with simple, sharp-pointed branches. Fourth pair of feet long and slender; the last joint terminating in a long curved claw, serrated on its inner edge, and two or three short spines at its base. Oviferous tubes nearly the length of the body.

Male. In the male, the last joint of the thorax is considerably smaller, and more of an ovoid shape, than in the female; while the abdomen is longer, narrower, and divided into two articulations, the first being the shorter. The terminating setæ are long, and densely plumose.

Third pair of foot-jaws large. In other respects much the same as female, but rather smaller.

This species strongly resembles the *C. minimus* of Otto; but there is no notch on frontal plates; the sides of the carapace are not hairy, and the antennæ are different, being much larger.

Hab.—Belfast Bay, W. Thompson, Esq. Taken from the gurnard (*Trigla hirundo et pini*), November 1839; the *Zeus faber*, in February; *Trigla gurnardus*, June; *Platessa limanda*, December; Lough Neagh trout, March; *Corregonus pollan*, Lough Neagh, November and December; the brett, *Rhombus vulgaris*, March, November, and December; *Merlangus vulgaris*, March and December.

2. Caligus Mülleri. Tab. XXXII, figs. 4, 5.

Caligus Mülleri, *Leach*, Enc. Brit. Supp., i, t. 20, f. 1-8.
— *Desmarest*, Cons. gén. Crust., t. 50, f. 4 *a-e*.

Description.—Female. Carapace oval, rather longer than broad, narrower at upper extremity. Frontal plates of considerable size, notched in the centre. Lunules well developed. Antennæ of considerable size; basal joint large. Thorax shorter than the carapace, about half the size; penultimate joint very small, of an elongate diamond shape; last joint nearly quadrilateral, and lobed at posterior extremity. On each lobe there are two very small tubercles, each of which gives off two short setæ.

Abdomen very short and rounded, broader than long. Caudal plates terminated by three tolerably long, plumose setæ. Sternal fork with simple, short, obtuse branches. Second pair of foot-jaws very long; the last joint being narrow, long, and terminated by two curved claws, one longer than the other. Fourth pair of legs stout; the first joint broad and thick, the last ending in one long, stout, curved claw, which is serrated on its inner edge, and two short ones. Oviferous tubes of considerable length.

Male. In the male the last joint of thorax is considerably smaller than in the female, and more rounded; the lobes much sharper, and terminated by the same tubercles, but of a larger size. Abdomen about two thirds the size of the last joint of thorax. Second pair of foot-jaws large.

Hab.—Belfast Bay, W. Thompson, Esq. Taken from the cod and brill, February, March, November, and December; *Merlangus pollachius,* March 1840; the brett (*Rhombus vulgaris*), March, November, December, 1837; *Merlangus vulgaris,* Flem., March, December, 1837; *Corregonus pollan,* Lough Neagh, November and December 1837; *Gadus ægelfinus,* December 1837; the plaice, Belfast, February 1844; *Mugil chelo,* Belfast, April 1840.

4. Caligus centrodonti. Tab. XXXII, figs. 6, 7.

Female. Carapace obovate; very much narrower in front than posteriorly. Frontal plates well developed, deeply notched in the centre. Lunules large, and nearly round. Basal joint of antennæ large.

Thorax much smaller than carapace; last joint quadrangular-shaped, narrow superiorly where it articulates with penultimate joint, and crescentic at inferior edge; nearly as broad as long; at each angle inferiorly giving off a small tubercle, armed with two setæ.

Abdomen exceedingly small; completely concealed by the ovarian tubes when filled with ova; of a somewhat square shape, and terminating in two rounded caudal lobes, each of which gives off four short, plumose setæ. Sternal fork well developed, with simple, stout, and sharp-pointed branches. Fourth pair of feet short and stout. Ovarian tubes nearly of the length of the whole body.

Male. Carapace as in female, but much larger in proportion to the size of the whole animal. Thorax much smaller; more completely quadrangular in shape, and more deeply crescentic on lower margin; broader than long; the inferior angles more acute, and giving off three short, stout setæ at a little distance from each other.

Abdomen very small, in shape of a half circle, the lower margin straight. Caudal segments large in proportion, oval, curved inwards, and giving off five stout, plumose setæ, the three internal ones the longest. The second pair of foot-jaws is very large.

Hab.—Taken from the tail and fins of the *Pagellus centrodonti*, October 29th, 1837; Dublin, Dr. Bellingham, W. Thompson, Esq.

Genus 2—Lepeoptheirus.[*]

Lepeoptheirus, *Nordmann*, Microgr. Beit., ii, 28.
Caligus (*pars*), *Kroyer*, *M. Edwards*, *Blainville*, *Cuvier*.

Character.—Fourth pair of feet slender, of only one branch, and serving the animal for walking. Thorax exhibiting only two distinct articulations. Frontal plates destitute of the small sucking-discs or lunules, on their under surface.

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[*] From λεπος, a scab; and φθειρ, a louse.

1. LEPEOPTHEIRUS STROMII. Tab. XXXII, figs. 8, 9.

CALIGUS STROMII, *Baird*, Trans. Berw. Nat. Club, 1847.
LAXE LUUS, *Strom*, Kiobenhavn. Selsk. Skrift., x, 23, t. 7, f. 1-7.
CALIGUS VESPA, *Edw. Thompson*, Ann. and Mag. Nat. Hist., xx, 248.

Description.—Female. Carapace oval. The frontal plates not very prominent. Thorax about the same length as carapace; last articulation narrower at upper extremity, broad posteriorly, and terminating in two rounded lobes. Abdomen long and narrow, nearly as long as the last joint of thorax. Caudal plates of moderate size, and giving off several stout, short, plumose setæ. Sternal fork short, with simple branches. The horny tubercles on the median line of posterior portion of thorax large, and simple. Oviferous tubes long, three or four times the length of the animal. Length of body (exclusive of tubes) about half an inch.

Male. The male is much smaller than the female. The carapace is oval, and much longer in proportion to the thorax than in the female; thorax oval-shaped, narrow, and notched rather than lobed posteriorly; the outer angles in form of a small protuberance, and armed with two or three short setæ. Abdomen much shorter than in female; terminal setæ of caudal appendages longer and finely plumose.

This species approaches very nearly the description of the *Caligus vespa* of M. Edwards. The *vespa*, however, is only three lines in length, and has the carapace narrow in front, and very broad posteriorly, and is as broad as long, while in this species the carapace is almost an exact oval, and the animal is half an inch in length. In *vespa*, the horny tubercle at the base of the thorax is small and setiferous; and in this species it is simple, and of considerable size.

Hab.—Berwick Bay; taken off the salmon, August 1844, W. B. Salmon at Berwick, Dr. Johnston. County Down, off the *Salmo trutta*, August; *Salmo salar*, July;

Salmo eriox, December. Off a salmon, at a salmon-leap on the river Bush, near Giant's Causeway, June 1837; and at Cushendale, April.* From the sea-trout, Donaghadee, April; † W. Thompson, Esq.

2. LEPEOPTHEIRUS PECTORALIS. Tab. XXXII, fig. 10.

LERNÆA PECTORALIS, *Müller*, Zool. Dan. i, 41, t. 33, f. 7; Encyclop. méthod., Vers, t. 78, f. 12.
CALIGUS PECTORALIS, *Kroyer*, Tidsskrift, ii, 8, t. 6, f. 4.
— *M. Edwards*, Hist. Nat. Crust., iii, 454, No. 9.
— *Thompson*, Ann. and Mag. Nat. Hist., xx, 247.
LEPEOPTHEIRUS PECTORALIS, *Nordmann*, Mikr. Beitr., ii, 30.
PECTORAL LERNÆA, *Shaw*, Nat. Miscell., viii, t. 295.

Description.—Female. Carapace oval. Frontal plates small, notched in centre. Antennæ small. Thorax fully as long as carapace. Penultimate joint very narrow; last joint nearly as large as carapace; almost quadrilateral, and slightly lobed at posterior extremity. Abdomen short. Caudal plates small; terminal setæ short. Sternal fork, with simple, sharp-pointed branches. Third pair of foot-jaws large. Fourth pair of feet small.

Hab.—Belfast Bay, W. Thompson, Esq. Off the flounder, John-dory, mackerel, dab, and sole, in March. The gemmous dragonet (*Callionymus lyra*), W. Yarrell, Esq.

3. LEPEOPTHEIRUS NORDMANNII. Tab. XXXIII, fig. 1.

CALIGUS NORDMANNII, *M. Edwards*, Hist. Nat. Crust., iii, 455, No. 10; Atlas Règne An. de Cuv., édit. Crochart, Crustac., t. 77, f. 1.
— *Thompson*, Ann. Mag. Nat. Hist., xx, 248.

Description.—Female. Carapace rounded oval, nearly as broad as long, diaphanous. Frontal plates of considerable size, rather prominent in centre, and not notched. Antennæ of moderate size. Thorax much shorter than carapace, narrow. Penultimate joint small; last joint rather longer than broad, obcordate, and deeply lobed at posterior extremity. Abdomen short. Caudal plates small; terminal setæ of moderate length and plumose. Sternal fork well developed, with long, simple, slender, sharp-pointed branches. Oviferous tubes long and slender. Males not seen.

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* Amongst these specimens were two or three males, and in one instance the male was firmly attached to the female by his strong third pair of foot-jaws.

† Some of these specimens were of a reddish hue, and shone with a metallic lustre.

Hab.—Found on *Orthagoriscus molæ;* taken on County Antrim coast, September 1848, W. Thompson, Esq.

4. Lepeoptheirus hippoglossi. Tab. XXXII, fig. 12.

Caligus hippoglossi, *Kroyer,* Tidsskrift, i, 625, t. 6, f. 3.
— *M. Edwards,* Hist. Nat. Crust, iii, 456, No. 14.
Binoculus piscinus, *O. Fabricius,* Faun. Grœnland., 239.

Description.—Female. Carapace large and rounded, deeply lobed on each side. Frontal plates of moderate size. Antennæ of considerable size, setiferous on edge and at extremity. Thorax about two thirds the length of the carapace, and much narrower; last joint elongate, quadrilateral, slightly lobed at each terminal angle. Abdomen very short. Caudal plates very small, and giving off four short, plumose setæ from each. Sternal fork twice bipartite; the branches of second fork short and truncate. Oviferous tubes rather longer than the body. The whole animal is beautifully marked with pink or red spots, distributed in an irregular pattern over the whole carapace, thorax, abdomen, and outer surface of fourth pair of legs. It is the most beautiful species I have seen; but the colours fade and disappear in spirits. Specimens of this elegant creature were sent several years ago by Dr. Johnston of Berwick to Mr. Westwood, who at that time was engaged upon the Crustacea, but they were not described. Since then the species has been described by Kroyer.

Hab.—Taken from the halibut, in Berwick Bay; Dr. Johnston.*

5. Lepeoptheirus obscurus. Tab. XXXII, fig. 11.

Carapace large, rounded oval. Frontal plates well-developed. Antennæ of considerable size, terminal articulation giving off at the apex eight or ten short setæ. Thorax very much smaller than carapace. Last articulation rounded on upper portion, and square at inferior part; laterally giving off, on each side, two sharp lobes, one situated immediately above the other, and armed with three rather long, plumose setæ.

Abdomen small; not more than one third the size of last ring of thorax, square-shaped; the centre of lower margin a little produced, and forming two very small lobes. Caudal plates stout, and giving off four long, finely-plumose setæ, the outer of which is the shortest. Sternal fork well developed, each branch being bifurcated; the inner branch being much smaller than the outer. The fourth pair of feet is very long and stout, extending, when stretched out, to fully the length of the thorax and abdomen together. The first joint is large, and the last terminates in three curved spines, the penultimate joint giving off one also.

Hab.—The brill, taken in Belfast Bay, February and March 1844; W. Thompson, Esq.

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* I am indebted to my much-valued friend Dr. Johnston, for very fine specimens of this pretty species, and for many other proofs of kindness during the time I have been preparing this monograph. I am glad of the opportunity thus afforded me of bearing testimony to his uniform attention and unvarying friendship.

6. LEPEOPTHEIRUS THOMPSONI. Tab. XXXIII, fig. 2.

Female. Carapace round. Frontal plates small. Antennæ well developed. Thorax about the fourth part the size of the carapace. Penultimate segment very small. The last nearly quadrilateral; the posterior edge deeply lobed. Abdomen long; the length of the thorax; upper portion narrow, and bulging out as it approaches the tail. Caudal plates short, rather broad, and giving off three long, plumose setæ, and two shorter ones. Sternal fork with sharp, simple branches.

Male.—Carapace round, but rather broader than in female. Thorax and abdomen both considerably shorter than in female.

Hab.—Taken from the turbot, March 1837, along with *Caligus Mulleri* and *C. diaphanus;* W. Thompson, Esq.

Genus 3—CHALIMUS.

CHALIMUS, *Burmeister*, Nov. Act. Acad. Nat. Cur. Bonn., xvii.
— *M. Edwards*, Hist. Nat. Crust., iii.
— *Kroyer*, Tidsskrift, ii.

Character.—Feet, as in preceding genera. Thorax exhibiting four distinct segments. Frontal plates without lunules, or sucking-discs, but provided with a long and slender appendage adapted for prehension, arising from the centre of its anterior surface.

The genus Chalimus was first established by Burmeister in the 'Nov. Act. Acad. Nat. Cur. Bonn.,' in 1835, to receive a small animal, closely allied to, and nearly resembling the Caligi, but possessing a long and slender appendage arising from the centre of the frontal plates, by which it fixes itself to its prey. He found it attached to a mackerel; but Kroyer afterwards discovered the same species adhering to a Caligus; and the only specimen I have yet met with, I found also parasitic upon an individual of that genus.

Kroyer seems disposed to consider it merely as the young of a Caligus, but farther observations are necessary to confirm this. The general appearance is that of a Lepeoptheirus; but we can trace four distinct articulations in the thorax, and three in the abdomen.

The frontal plates are well developed, and want the small lunules or sucking-discs on the lateral portions; but instead of these, have arising from the central part of its anterior margin a long and slender organ, rather indistinctly articulated at its base, and terminated by a round expansion like a sucker, by which it fastens itself to the body to which it is found attached. The presence of this organ would lead us to suppose that this animal must lead a much more sedentary life than the rest of the Caligidæ; and it would appear in this respect to connect it with some of the Lerneadæ, which we shall find to possess a somewhat similar organ of prehension.

1. Chalimus scombri. Tab. XXXIII, figs. 5, 5 *a*, *b*.

Chalimus scombri, *Burmeister*, Nov. Act. Acad. Nat. Cur. Bonn., xvii, 294, t. 23, f. 13.
— *Kroyer*, Tidsskrift, ii, t. 1, f. 1.
— *M. Edwards*, Hist. Nat. Crust., iii, 457.

Description.—Carapace elongated oval, somewhat narrower at the anterior extremity, and then gradually becoming broader posteriorly. Frontal plates large, well-developed, and prominent. Thorax composed of four distinct segments. Abdomen large, and consisting of three joints; the last terminated by two tolerably-sized caudal-plates, each sending off three or four short setæ.

Hab.—Belfast Bay, attached to a *Caligus Mulleri*, W. Thompson, Esq.

Genus 4—Trebius.

Trebius, *Kroyer*, Tidsskrift.
— *M. Edwards*, Hist. Nat. Crust.
— *Thompson*, Ann. and Mag. Nat. Hist.

Character.—Fourth pair of feet slender, and divided into two branches, adapted for swimming. Thorax possessed of three distinct articulations. Frontal plates destitute of small sucking-discs or lunules.

1. Trebius caudatus. Tab. XXXIII, figs. 3, 4.

Trebius caudatus, *Kroyer*, Tidsskrift, ii, 30, t. 1, f. 4.
— *M. Edwards*, Hist. Nat. Crust., iii, 458.
— *Thompson*, Ann. and Mag. Nat. Hist., xx, 248.

Description.—Female. Carapace nearly oval, rather longer than broad. Frontal plates of considerable size.

Antennæ well developed; setæ on external edge of basal joint plumose.

Thorax narrow on first two joints, especially on second; last nearly quadrilateral, a little narrower at upper extremity than lower, which is nearly straight on the edge.

Abdomen long and narrow, nearly as long as the thorax, slightly narrowed towards the centre, and terminated by two small caudal appendages, which give off three long and one short plumose setæ. Sternal fork with simple branches.

First pair of foot-jaws larger than in any of the Caligi, and strongly hooked at their apex. Third pair much smaller. Fourth pair of feet short, with basal joint broad, and the two terminating articulations short, oval, and furnished with several rather stout setæ. Oviferous tubes short, and rather broad.

Male. The male is much smaller than the female. Carapace broader.

Thorax, two first segments of much the same form as in the female; last joint somewhat hexagonal.

Abdomen shorter and broader than in the female, and divided into two articulations, the last of which gives off two caudal appendages, considerably larger than those of the female, and armed at their extremity with the same number of, but longer, plumose setæ.

Antennæ, foot-jaws, and feet as in female.

Hab.—Belfast Bay; W. Thompson, Esq. Taken off the *Raia batis*, or skate, September 1838.

Family PANDARIDÆ.

PANDARIENS (*pars*), *M. Edwards*, Hist. Nat. Crust., iii, 461.
CALIGIDÆ, RACE III (*pars*), *Leach*, Dict. Sc. Nat., xiv.
PANDARINÆ, *Dana*, Proc. Amer. Acad.

Character.—Head in form of a small buckler, provided with frontal plates. A series of one or more pairs of lamellar appendages, like the elytra of many insects, extend along the dorsal surface of the thorax. Oviferous tubes straight, external.

This family contains only two British genera.

1. DINEMOURA.—Elytraform appendages, one pair. Three first pairs of feet setiferous; the posterior foliaceous and membranous.

2. PANDARUS.—Elytraform appendages, several pairs. All the feet fitted to a certain extent for walking, and armed near their extremities with short, thick hooks.

Genus 1—DINEMOURA.*

DINEMOURA, *Latreille,* Cuv. Règne Anim., iv, 197.
— *M. Edwards,* Hist. Nat. Crust., iii.
DINEMURA, *Nordmann,* Mikrog. Beitr.
DINEMATURA, *Burmeister,* Nov. Act. Acad. Nat. Cur., xvii.
— *Dana,* Proc. Am. Acad. Arts and Sc. 1849, p. 60.
PANDARUS, *M. Edwards,* Ann. Sc. Nat., xxviii.
— *Johnston,* Loudon's Mag. Nat. Hist., viii.

Character.—Lamellar elytraform appendages covering the thorax, only one pair. Three first pairs of feet setiferous; the posterior foliaceous and membranous.

Bibliographical History.—A species of this genus is figured by Herbst, in the Berlin 'Gesellsch. Skrift.,' 1780, and described under the name of "See-laus vom Hemorfisch;" but the genus was first established by M. Latreille (Cuv. Règne An., iv, 1829), to receive the species of Caligus described by Müller under the name of *Caligus productus.* It was not remarkably well characterised or defined, being taken from the figure merely of that species, as given by Müller; but it has been adopted by succeeding naturalists to a greater or less extent, and latterly more distinctly defined and limited by M. Edwards, in his 'Hist. Nat. Crust.' Burmeister, in the 'Nov. Act. Acad. Nat. Cur.,' xvii, objected to the name, and proposed that of Dinematura, as being more euphonious and more grammatically constructed. Judging, however, from his figures and descriptions, it is evident that his genus Dinematura is quite different from the Dinemoura of Latreille, taking the *Caligus productus* as the type; and as M. Edwards very properly points out (l. c. iii, 463, note), it is synonymous with the genus Nogaus of Leach, already well defined by that author several years previously. M. Edwards, in adopting this genus, as distinct from Pandarus of Leach, points out distinct generic characters, and sets it upon a better foundation than had heretofore been done. Dr. Johnston has described two species belonging to this restricted genus, but under the name of Pandarus, both of which species were taken at Berwick-upon-Tweed.

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* From δις, two; *νημα,* a thread; and *ουρα,* a tail.

Anatomy.—The body of the animals belonging to this genus is of an oblong shape, resembling considerably that of the Caligidæ, and divisible, as in them, into head, thorax, and abdomen.

The cephalo-thorax, including the head and the first ring of the thorax, is in form of a shield or buckler, and somewhat of the same form and sculpture as in the Caligidæ, being divided into several distinct portions, as in them, by deep furrows. The thorax is longer and narrower than the carapace.

The articulations are very indistinct; but M. Edwards enumerates five. The first is confounded with the head, and the second and third are small, and so united together as to appear only one. It is of a quadrilateral form, and occupies the space left by the deep notch in the posterior part of the carapace. The fourth segment is about the size of the two preceding, but has attached to it two large moveable plates, which cover the whole articulation, and extend, like the elytra of insects, over part of the succeeding joint also. The fifth or last ring is the largest of all, and extends beyond the abdomen, nearly concealing it altogether. It terminates posteriorly in two rounded lobes, which have a deep notch between them, in which is seen the abdomen. This part of the body is small, of a square shape, and has appended to its extremity two caudal appendages, slightly ciliated on the lower margin, and varying in size in the two sexes. In the female they are much smaller than in the male, and she has two long oviferous tubes, such as the Caligi possess, much longer than the whole body of the animal, and arising near the posterior edge of the last segment of the thorax. The anterior portion of the carapace possesses, like the Caligidæ, the small, narrow, transverse frontal plates, and springing immediately from beneath their terminal point, we see the antennæ. These are very small, and consist of two short, simple articulations.

The structure of the mouth is also very similar to that of the Caligidæ, consisting of a sucking-tube, inclosed within a sheath, and one pair of rudimentary organs attached to its sides, equivalent to the jaws. The *style* of the sucking-tube is longer and more slender than in Caligus, and there is only one pair of rudimentary organs, representing the first pair of jaws, the smaller and more external pair being wanting. The foot-jaws are three pairs. The first differ from the corresponding pair of the Caligidæ, in having at their base a large fleshy-looking lobe, and in wanting the horny-looking, hooked spine which springs from near its base. The second and third are similar in structure to the corresponding pairs of the Caligi; but we see no trace of what has been described in them as the sternum.

The feet are four pairs, and are attached to the different segments of the thorax. The three first pairs are short, divided into two stalks, each consisting of two or three flat joints, which are beset with short cilia. The basilar joint in each foot, from which the two stalks spring, shows much the same form as that in the Caligi. The fourth pair of feet differs from the others considerably. Instead of the two stalks being small, jointed, and armed with setæ, they are each of only one joint, and that large, membranous, of an oval shape, and not possessing any setæ or hairs on their margin at all.

On the under surface of the last segment of the thorax, very near where it articulates with the abdomen, there is a small forked, horny body, which M. Edwards considers as a rudimentary fifth pair of feet.

1. Dinemoura alata. Tab. XXXIII, figs. 6, 7.

Pandarus alatus, *M. Edwards*, Ann. Sc. Nat., xxviii, t. 8.
— *Johnston*, Loudon's Mag. Nat. Hist., viii, 203, f. 22 *a*, *b*.
Dinematura alata, *Burmeister*, Nov. Act. Acad. Nat. Cur., xviii, 331.
Dinemoura alata, *M. Edwards*, Hist. Nat. Crust., iii, 464.

Description.— Body oblong, about half an inch in length and two tenths of an inch broad.

Cephalo-thorax squarely rounded; slightly notched in front. Dorsal plates, or elytra, convex and smooth, about the same breadth behind as in front, and occupying about a third of the length of the whole body. Their posterior margin is cut even, but obliquely. They are of a chesnut colour, very faintly scored, and marked with pale, scattered dots. The under surface of the body is of a dead white.

The last segment of the thorax is nearly of the same length as the elytra, and has at its extremity a small, horny tooth.

The caudal appendages of abdomen scarcely project beyond the last segment of the thorax. They are broad and somewhat square-shaped in the male; longer and narrow in the female, and have at their extremities several short setæ.

This species was taken by Dr. Johnston from a Beaumaris shark, in Berwick Bay, in 1834; and he observes, that it "appears parasitical on several species of fish. It generally attaches itself to the sides of the branchial covers, adhering tenaciously, by thrusting the claws of the first and third pairs of feet* through the skin."

Hab.—Beaumaris shark, Berwick Bay; Dr. Johnston.

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* Foot-jaws.

2. Dinemoura lamnæ. Tab. XXXIII, fig. 8.

Pandarus lamnæ, *Johnston*, Loudon's Mag. Nat. Hist., viii, 204, f. 22 *a, b*.

Seelaus vom Hemorfisch, *Herbst*, Berlin Gesellsch. Skrift., i, t. 3, f. 1-8.

Description.—Body linear oblong. Cephalo-thorax round, slightly notched in front, convex dorsally, and of a pale colour, with a brown blotch in front.

Dorsal plates, or elytra, much smaller in proportion than in preceding species; narrower, and occupying only about a fifth of the length of the body; oval, smooth, rounded at their posterior margin, and of a uniform pale colour.

The last segment of thorax is long and narrow, about twice the length of the elytra, and rounded at the posterior extremity. The centre of the upper part is marked with a long, black spot.

Caudal appendages of abdomen large, oblong, and giving off four stout, plumose spines. Oviferous tubes long, more than twice the length of the whole body.

Hab.—Taken from a Beaumaris shark (*Lamna Monensis*), in Berwick Bay, September 1834; Dr. Johnston.

Genus 2.—Pandarus.

Pandarus, *Leach, Latreille, Desmarest, Say, Burmeister, Kroyer, M. Edwards, Dana.*

Caligus (*sp.*), *Lamarck.*

Character.—Lamellar elytraform appendages, several pairs in number. All the feet fitted, to a certain extent, for walking, and armed near their extremities with short, thick hooks.

Bibliographical History.—This genus was first established by Dr. Leach, in the Supplement to the 'Encyclopædia Britannica,' in 1816, and afterwards in the 'Dict. des Sc. Nat.,' 1819. He described several species belonging to the genus, two of which are British. Since then the genus has been adopted by Latreille, Desmarest, Kroyer, M. Edwards, &c., and several new species added to it.

Anatomy.—The body of the animals belonging to this genus is of an irregular oval form. The head is much narrower than in the preceding genus, and we see none of the furrows in the cephalo-thorax which are so well marked in the Dinemouræ and Caligidæ. The frontal plates, however, are more largely developed, especially laterally, where they are of considerable breadth, though contracted in the centre.

The thorax is divided into four distinct segments, though the first is concealed under the head, and is so closely articulated with the second as to be confounded with it. Each of these segments has attached to it one or two lamellar appendages, extending downwards, and mutually covering each other. Those of the first segment are a pair, and are situated at the sides of the thorax, leaving a space between them, which is occupied by the second joint. This joint gives origin to another elytraform appendage, which is single, but deeply notched in the middle. The third segment has a similar appendage, but much larger, extending across the body, and deeply notched in the centre also. The last ring has no appendage attached to it, but it is of considerable size.

The abdomen consists of two segments. The first is concealed under the second, and has attached to it on each side a small appendage, toothed on the inner edge. These are considered by M. Edwards as equivalent to the caudal appendages. The second is the larger of the two.

The antennæ are very small, as in the last genus, but have near their base a small, fleshy, projecting lobe ; and the mouth-apparatus resembles closely that of Dinemoura also. The foot-jaws are short, and do not differ in structure from those of Dinemoura. There is no sternum.

The feet are four pairs ; they are all composed of two branches. The first three pairs are each composed of two joints, all of which are armed at their extremities with a series of short sharp hooks. The last pair has only one joint to each branch, and the outer branch alone has the hooks. These hooks are evidently useful to the animal in moving or walking, by enabling it to attach itself to the bodies upon which it creeps. The oviferous tubes take their origin from the last thoracic segment, though at first sight they appear to spring from the last abdominal ring.

1. Pandarus bicolor. Tab. XXXIII, fig. 10.

Pandarus bicolor, *Leach,* Encyc. Brit. Supp., i, 405, t. 20, f. 1, 2; Dict. des Sc. Nat., xiv, 535.
— *Desmarest,* Cons. gén. Crust., 339. t. 5, f. 5.
— *M. Edwards,* Hist. Nat. Crust., iii, 470.
— *Burmeister,* Nov. Act. Acad. Nat. Cur., xviii, 331.
— *Kroyer,* Tidsskrift, ii, t. 1, f. 6 (?).
Caligus bicolor, *Lamarck,* An. s. Vert., edit. 2d, v, 210.

Description.—The body is much elongated and oval. Frontal plates large, and separated from each other by a deep notch. Hinder edge of the carapace almost smooth. Elytraform appendage of the second thoracic segment scarcely extending beyond the appendages of the first ring; that of the third segment is narrowed towards the extremity. The last thoracic segment is of a somewhat oval form, and surrounded by a small pale border. The last abdominal ring is somewhat rounded, and the lateral caudal appendages are short and obtuse. The cephalothoracic segment and the second and third thoracic elytraform appendages are marked in the centre with patches of black.

Hab.—Taken from the *Squalus galeus,* Linn., at Torcross, Devonshire; Dr. Leach. British Museum. From the *Carcharius glaucus,* captured a few miles from the harbour of Falmouth, 1849; W. P. Cocks, Esq.

2. PANDARUS BOSCII.

PANDARUS BOSCII, *Leach*, Encyc. Brit. Supp., i, 406, t. 20, f. 1-10
Dict. des Sc. Nat., xiv, 535.
— *Desmarest*, Cons. gén Crust., 339.
CALIGUS BICOLOR (*var.*), *Lamarck*, An. s. Vert., v, 210.

Description.—This species is extremely similar to the preceding. It is smaller, and the whole body is of a pale colour, without any of the black marks which characterise the *bicolor*. Most probably only a variety.

Hab.—Taken from the *Squalus mustelus*, Linn., at Torcross, Devonshire; Dr. Leach. British Museum.

Family 4—CECROPIDÆ.

PANDARIENS (*pars*), *M. Edwards*, Hist. Nat. Crust., iii, 461.
CALIGIDÆ, RACE II, *Leach*, Dict. Sc. Nat., xiv.
BOPYRIDÆ (*pars*), *Risso*, Hist. Nat. Eur. mérid.
CECROPINÆ, *Dana*, Proc. Am. Acad. Arts and Sc., 1849, 54.

Character.—Head as in Pandaridæ. One single, lamellar, elytraform appendage on the dorsal surface of the thorax. Oviferous tubes, concealed under a shield-shaped plate, and twisted in many convolutions.

Genus 1—CECROPS.

CECROPS, *Leach*, Enc. Brit. Supp., i, 1816; Dict. Sc. Nat., xiv, 1819.
— *Lamarck, Latreille, Desmarest, Nordmann, Burmeister, M. Edwards.*

Character.—Elytraform appendage small, and rounded. First three pairs of feet in the female, and all in the male, fitted more or less for walking, and armed at the tips with short, stout spines.

Bibliographical History.—Lamartinière, who was naturalist in the expedition sent out under the command of La Pérouse, discovered a small parasitic animal adhering to the gills of a species of Diodon, or sun-fish, taken on the coast to the north-east of Nootka Sound. This unfortunate fish seems to have been in a diseased state, and had three other species of parasites adhering to different parts of its body. The one taken from the gills he describes as a species of *Oniscus*, and figures it in the atlas to 'La Pérouse's Voyage,' and also in the 'Journal de Physique' for September 1787. His description and figure show it to be a species of the genus Cecrops. It was Leach, however, who first established the genus in the 'Enc. Brit. Supp.,' i, 1816, and afterwards in the 'Dict. de Sc. Nat.' xiv, 1819. He there pointed out the difference in the situation of the oviferous tubes; and the genus thus established was afterwards adopted by Lamarck, Latreille, Desmarest, Nordmann, Burmeister, Kroyer, Edwards, &c.

Anatomy, &c.—The body is oval, thick, and of a light horny colour and substance. The cephalo-thoracic portion is of a square shape; in the male two thirds the size of the whole body, and in the female about one third.

The frontal margin has two projecting plates of considerable size, rounded, and separated from each other by a deep notch.

The dorsal surface is marked by a rather deep furrow on each side, which divides this portion of the body into three parts, the middle of a somewhat quadrilateral shape, the lower side being the narrower, and the two lateral parts of a triangular form. The inferior angles of these project downwards on each side, considerably lower than the middle portion, and have the first free segment of the thorax lying between them. This portion is small, and quadrilateral; but the succeeding ring is of considerable size, and has attached to its upper surface a lamellar plate, like the elytraform appendages found in Dinemoura, only it is single, and smaller than in that genus, of a rounded form, and notched at the middle of its posterior margin.

The last segment of the thorax is very small in the male, and is covered by this lamellar plate entirely, but in the female it is very large, nearly half the size of the whole body. It resembles a large buckler, swollen out laterally, and covers the whole abdomen. The posterior margin is lobed at the corners, and notched in the middle.

The abdomen is very small in the male, but in the female it is of considerable size, two-lobed, and notched posteriorly. The caudal appendages are very small, of an oval form, and have three or four short hairs springing from their inferior margin.

The antennæ are very small, and consist of two short articulations. The mouth-apparatus resembles closely that of the preceding genus.

The foot-jaws are three pairs. The first pair is of considerable size, consisting of two stout joints, and a terminal, strong, sharp claw, deeply tinged with black. The second pair is much smaller; consisting also of two joints, and two terminating claws, one much smaller than the other, and both of the same colour as the rest of the body. The third pair is much the largest, and exactly resembles in form and structure the first pair.

The feet are four pairs. In the male they are all small. The first pair consists of two branches, of unequal length, arising from a common basal joint, of moderate size. Each branch is composed of two short joints, the last of which gives off three terminal setæ. The internal branch is considerably the smaller of the two. The second and third pairs have the same structure, only the basal joint is in the form of a plate, extending across to each side, while the fourth pair, in addition to its having this plate larger, has the two branches composed of only one articulation each, and this one broader and larger than in the preceding. In the female, the first three pairs of feet are formed as in the male, the first having a moderate-sized basal joint, while the two others have the same plate, of which the basal joint is composed, much broader and larger. The fourth pair is very large in proportion, and consists each of a broad, foliaceous, elongated plate, as a basal joint, and one small single branch springing from its side. The inferior edge of this plate is sharply notched, and on its upper surface, covered by the last segment of the thorax, there is a thick, waved, projecting fold.

The oviferous tubes spring, as is usual in the animals of this order, from the inferior surface of the last thoracic segment of the body, where it articulates with the abdomen. They are very long and slender, but instead of projecting externally, as in the other families already described, they are twisted upon each other in numerous loops, and lie concealed in the hollow space between the abdomen and the large, buckler-shaped, last segment of the thorax. This peculiar structure was pointed out by Lamartinière, but he fancied these tubes to be the intestines. In the specimen he describes, he says, "son ventre était rempli par un paquet d'intestins de forme ventriculaire, de la grosseur d'un cheveu." (Loc. cit., p. 207.)

Little has been observed of the habits and manners of the animals of this genus. Lamartinière found them fixed upon the gills of the Diodon, or sun-fish of the coasts of California. In the specimens from the Irish coast and from the English shores, they were taken from the *Orthagoriscus molæ,* or short sun-fish. They have been taken off the same fish on the French coast. Risso says, that those in the Mediterranean "float in thousands upon the surface of the sea, far away from the coast, and serve as food for the wandering fishes, especially the *Cephale lune,* whose stomach is always filled with an astonishing quantity of these animals."—Hist. Nat. Eur. mér., v, 141.

1. **Cecrops Latreillii.** Tab. XXXIV, figs. 1, 2.

Cecrops Latreillii, *Leach*, Enc. Brit. Supp., i, t. 20, f. 1-5.
— *Lamarck*, An. s. Vert., edit. 1st, v, 138.
— *Latreille*, Enc. méth., t. 335, f. 3-9.
— *Desmarest*, Cons. sur les Crust., 338, t. 50, f. 2.
— *Guerin*, Icon. Régne An. Crust., t. 35, f. 8.
— *M. Edwards*, Hist. Nat. Crust., iii, 474.

Description.—This animal is about an inch long (the female), and is of a pale horny colour. The frontal edge of the carapace is deeply notched, as is also, in a less degree, the lower margin of the elytraform appendage, and the last thoracic segment of the body. The terminating strong hooks of the foot-jaws are of a deep black colour, contrasting strongly with the light horny colour of the rest of the body. The male is not above one third the size of the female.

Hab.—On the *Orthagoriscus molæ*, Kinsale, G. J. Allman, Esq., August 1848. Dublin coast, R. Ball, Esq., W. Thompson, Esq. Selsey Bill, near Bognor, Sussex, August 1835-6 (?), G. Newport, Esq., British Museum. Weymouth, Professor E. Forbes, and R. M'Andrew, Esq. In all these instances they were taken from the sun-fish, and adhering to the gills.

Genus 2—Læmargus.

Læmargus, *Kroyer*, i, 500.
— *M. Edwards*, Hist. Nat. Crust, iii, 474.

Character.—Elytraform appendage of considerable size. The feet are foliaceous and branchial. The upper segments of the thorax are distinct and small.

Bibliographical History.—Kroyer established the genus in his 'Tidsskrift,' in 1838. Finding all the feet foliaceous and branchial, he considered it a sufficient character to separate the species from Cecrops, to which it is so nearly allied, and form it into a distinct genus. M.

Edwards afterwards adopted the genus, in his 'History of the Crustacea.'

Anatomy, &c.—The body is of an ovoid shape, and of a light horny colour and substance. The cephalo-thorax, which includes the head and the first ring of the thorax, is somewhat swollen, and of a round figure in front, and cut square at its posterior margin. It is smooth on its dorsal surface, and does not appear divided into different regions, as in Cecrops. The second and third segments of the thorax are distinct, small, and narrow. The fourth is considerably larger, and has attached to its upper edge a large elytraform plate, which covers a great part of the last segment. This segment is much the largest of all, and in the female is dilated into the form of a broad and rounded elytraform plate, which covers the abdomen entirely. In the male it is not so large, and is simply two-lobed.

The abdomen, in the female, is large, oval, and deeply notched posteriorly, and rounded at the sides into two lobes; whilst in the male it is short and narrow. The caudal appendages are small, and of an oval shape, with four short, stout setæ or spines, springing from their posterior edge. The antennæ are small, composed of three short articulations; the mouth-apparatus is of moderate size, and the structure of these parts and the foot-jaws is the same as in Cecrops.

The males are much smaller than the females. The young, from the figure of Kroyer, appear to resemble a good deal the form of the Cyclopidæ. The cephalo-thoracic portion is large, and quadrilateral in shape, and there are five distinct segments to be seen in the body, gradually diminishing in size as they descend, without any appearance of the elytraform appendages. It appears to have two large round eyes, situated in the front of the carapace. The antennæ and the feet are more largely developed than in the adult.

1. Læmargus muricatus. Tab. XXXIV, figs. 3, 4.

Læmargus muricatus, *Kroyer*, Tidsskrift, i, 487, t. 5, f. a, b, c, d.
— *M. Edwards*, Hist. Nat. Crust., iii, 475, t. 39, f. 2.

Description.—The female of this little animal is about ten lines, or nearly an inch in length, and of a light horny colour. The carapace or cephalo-thorax is considerably smaller than the rest of the body, and is studded all over with numerous small prickly tubercles. The elytraform plate and last thoracic segment are finely serrated round the lower margins, and are both deeply notched. The male is about half an inch in length.

Hab.—On the *Orthagoriscus molæ*, or short sun-fish, W. Yarrell, Esq.

Tribe 2—*PACHYCEPHALA*.*

In the animals belonging to this tribe, the head is generally much smaller than in those of the preceding, and has not the broad, flat, shield-shaped form that these have, nor the lamellar plates on the front part, but is generally rather thick and obtuse.

The antennæ are much longer than those in the Peltocephala, and are composed of five and six, and even more, articulations. The thorax varies in the different genera, in form and in the number of articulations of which it is composed. The mouth-apparatus is generally less strongly developed in these genera than in the others, and the conformation of the foot-jaws is much less regular. The feet of the animals belonging to the Pachycephala differ also from those organs in the Peltocephala. They are not, as in these latter, attached to a basal joint, which extends across the under surface of the thorax in the shape of a broad plate, but have their basal joints detached from each other. They are all parasitic, and when young undergo a metamorphosis like the Cyclopidæ.

* Παχυς, thick, and κεφαλη, head.

We have only one British family belonging to this tribe.

Family ANTHOSOMADÆ.

DICHELESTIDÆ (*pars*), *M. Edwards.*
CALIGIDÆ, RACE I (*pars*), *Leach*, Dict. Sc. Nat.
— *Desmarest*, Cons. gén. Crust.
ERGASILINA (*pars*), *Kroyer, Burmeister.*

Character.—Head of considerable size, in form of a narrow, ovoid, convex buckler, and having attached to it near the mouth a pair of large foot-jaws, armed with strong hooks. Thorax furnished with elytraform appendages. Feet, three pairs; all foliaceous.

Genus ANTHOSOMA.

ANTHOSOMA, *Leach, Desmarest, Kroyer, M. Edwards, Burmeister, Latreille, &c.*
CALIGUS, *Abildgaard, Risso, Lamarck.*
OTROPHESA, *Risso,* Hist. Nat. Eur. mérid.

Bibliographical History.—Abildgaard was the first person who noticed any of the species of this genus. In the Mém. de Copenhagen, 'Act. Soc. Nat. Havn.,' 1794, he describes a species under the name of *Caligus crassus*, with considerable details, pointing out its peculiar conformation.

Leach, however, was the first to form the genus; perhaps without knowing Abildgaard's description or figure, as he took as the type of his new genus a specimen taken from a shark on the coast of England. He first described it in the 'Encyclopædia Britannica,' 1816, and afterwards in the 'Dict. Sc. Nat.,' 1819.

About the same time as Leach described the individual from which he formed the genus, Risso described shortly, and figured very badly, the same species from the Mediterranean. In his 'Crustac. des Envir. de Nice,' 1816, he describes a species of Caligus, under the name of *Caligus imbricatus*, which Leach ascertained from Risso's own specimens to be identical with his Anthosoma, though the figure given in the work quoted above was so bad as to make it almost impossible to identify it from that alone. In 1826 Risso described it again in his 'Hist. Nat. Eur. mérid.,' under the name of *Otrophesa imbricata*, giving Leach as his authority for the generic name!

Lamarck retains the name of Caligus, but Latreille, Kroyer, M. Edwards, and other authors, have adopted the genus, though only one species has as yet apparently been described, unless the species described by Abildgaard may be considered different.

Anatomy and Physiology, &c.—The general form of the animal is oval; and we distinguish as usual the head, thorax, and abdomen.

The head is of tolerable size, and distinct, consisting of a stout, rather narrow, and strongly convex, horny buckler of an ovoid shape. It is very narrow, thick, and obtuse in front, where it has a furrow running across its dorsal surface, and a deep notch on each side, which thus forms a beak, and almost divides it into a separate segment. It extends backwards for some length, and becomes considerably broader, covering a portion of the thorax.

The segments of the thorax are very indistinct. On the dorsal aspect we perceive two foliaceous elytraform appendages of an oval shape, and of a light horny and somewhat granulated texture. Beneath these the remaining portion of the thorax is seen, of a fleshy structure, and apparently without any divisions.

The abdomen is very small, consisting of one short segment, which gives off two small caudal appendages, in form of short, flat, blunt filaments of the same texture as the elytraform appendages. Immediately beneath the notch, on each side of the blunt beak, we see a small, flat body, and from near the base of each of these we find the origin of the antennæ. These organs are rather long and slender, and consist of six articulations, tapering from the base to the extremity.

The most remarkable organs attached to the head, however, are the first pair of foot-jaws. These arise from between the base of the antennæ, are very large and strong, and project forwards beyond the head. They consist of three stout joints, of considerable length, and of a cylindrical shape; the second joint, near its apex, having a tooth or spine, and the last being terminated by a curved hook; the hook pointed upwards and backwards. The second pair, of three joints also, is of nearly equal length, but much more slender, and has the terminal joint ovate, compressed, and bifid. The third pair is short, very thick, stout, of two joints, and terminates in a strong claw-shaped extremity.

The mouth-apparatus resembles much that of the other genera already described belonging to the Peltocephala; but the sucking-tube is not so conical or sharp-pointed.

The feet are three pairs, and are all foliaceous. The structure of these members is very simple; being merely foliaceous lamellæ, which lap over each other, and surround the thorax as with a shield. They are of a light horny texture, and somewhat granulated like the dorsal elytra-form appendages. The oviferous tubes are straight and very long.

From the form of the feet, and the large development and prehensile structure of the foot-jaws, it is evident that the animals belonging to this genus are incapable of much motion, and are more adapted than any of the others we have yet described, for living strictly as parasites. They seem, from Leach's figure of the species he describes (*in situ*), to bury their beak in the flesh of their prey, and no doubt cause much irritation to their unwilling host. The gill-covers to which they were found adhering, showed the marks of inflammation of long standing, as they were much thickened.

1. ANTHOSOMA SMITHII. Tab. XXXIII, fig. 9.

ANTHOSOMA SMITHII, *Leach*, Enc. Brit. Supp., i, 406, t. 20, f. 1-6; Edinb. Encyclopæd., t. 181; Dict. Sc. Nat., xiv. 533.
— *Desmarest*, Cons. gén. Crust., 335, t. 50, f. 3.
— *Latreille*, Cuv. Règne Anim., iv, 198; Enc. méth., t. 335, f. 11-16.
— *Guerin*, Icon. Cuv. Règne Anim., t. 35, f. 9.
— *Griffith*, An. Kingd. Crust., t. 21, f. 2.
— *Kroyer*, Tidsskrift, ii. 295, t. 2, f. 2.
— *M. Edwards*, Hist. Nat. Crust., iii, 483, t. 39, f. 5; Cuv. Règne Anim., édit. Crochart, Crust., t. 79, f. 3.
CALIGUS SMITHII, *Lamarck*, An. s. Vert., v. 210.
CALIGUS IMBRICATUS, *Risso*, Hist. Nat. Crust. Nice, 162, t. 3, f. 13.
OTROPHESA IMBRICATA, *Risso*, Hist. Nat. Eur. mérid., v, 136, No. 190.

Description.—Animal of an elongated oval form, about ten lines in length; and of a ferruginous white colour, bordering upon yellow. When alive it has a black spot upon the middle of the head, which disappears after death. The dorsal elytraform appendages and the foliaceous feet are sprinkled over with semitransparent spots.

Hab.—Discovered sticking to a shark (the *Lamna cornubica*) thrown ashore at Exmouth, Devonshire, by T. Smith, Esq., of the Temple, who sent it to Dr. Leach. British Museum.

Family ERGASILIDÆ.

ERGASILIENS, *M. Edwards*, Hist. Nat. Crust., iii, 476.
NICOTHOIDÆ, *Dana*, Proc. Am. Acad. Arts and Sc., 1849.

Character.—Head of moderate size, and rounded. Body of an ovoid or pyriform shape, the thorax being sometimes much enlarged laterally. Feet very small, and branched. Abdomen well developed.

Genus NICOTHOE.*

NICOTHOE, *M. Edwards and Audouin*, Ann. Sc. Nat., ix, 345.
— *M. Edwards*, Hist. Nat. Crust., iii, 480.
— *Latreille*, Cuv. Règne Anim., iv, 201.
— *Burmeister*, Nov. Act. Nat. Cur., xvii, 327.
— *Kroyer*, Tidsskrift, i.
— *Rathke*, Nov. Act. Nat. Cur., xx, 102.

Character.—Two eyes. Antennæ slender, many-jointed. Foot-jaws very small. Thorax enlarged laterally into the form of two large, wing-shaped lobes. Feet four pairs, two-branched, and jointed. Body articulated.

Bibliographical History.—MM. Audouin and M. Edwards were the first who noticed the Nicothoe, and in their memoir, published in 1826 in the 'Ann. Sc. Nat.,' they give a lengthened account of the genus. They seem to have been struck with the peculiar appearance of these singular creatures, and evidently had some difficulty in ascertaining their true position. Seen from above, with their large, wing-shaped, lateral expansions, they appeared to them to belong to the Lerneadæ. When reversed, and exhibiting their jointed antennæ and articulated feet, they had a close resemblance to the Cyclopidæ. "Except that they have two eyes," they say, "we would not think of separating them from these animals."

Latreille, in his "History of the Crustacea," in Cuvier's 'Règne Animal,' in 1829, places them at the end of the Siphonostoma in his second division, the Lerneiformes, as coming next to the Lerneæ.

M. Edwards afterwards adopted the same position for the genus, in his 'Hist. Nat. Crust.,' and this arrangement has, in like manner, been followed by later authors.

Rathke is the latest writer who has noticed the Nicothoe, and in his memoir in vol. xx of the 'Nova Acta,' he has given us many details of the development of the young, from the egg up towards maturity, of a highly interesting nature.

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* Nicothoa, one of the Harpies.

Anatomy and Physiology, &c.—The figure of the body is conical, with two enormous lateral expansions, and we can distinguish three distinct parts; the head, thorax, and abdomen.

The head is moderately small, rounded, and obtuse. The eyes are two; simple, circular, and situated on the frontal edge. The antennæ arise from under this frontal margin, and are very slender, consisting of ten or eleven small articulations,* each of which is furnished with a very small seta. The mouth and the organs belonging to it are very small. These consist of a short, truncated, cylindrical tube, of a tolerably thick substance, and a horny texture, and within its cavity what Rathke believes to be two mandibles. These latter organs, however, are so minute, that he could not state positively what they were, nor could he figure them.

The foot-jaws are three pairs in number. The first pair is nearly rudimentary, and appears to be fringed with several short bristles. The second pair is somewhat larger, conical, and consists of two joints, the terminal joint having at its extremity two moderately strong teeth. The third pair is considerably larger than the preceding, and consists each of three articulations, the first and second of which are rather long, and moderately thick, and the terminal one is in form of a sharp-pointed claw, which is somewhat prolonged, and furnished on the concave side with two teeth.

The thorax is very large compared with the size of the head, and consists of five segments. It extends laterally, in the form of two wing-like lobes, or wallet-shaped appendages, which diverge at first nearly at right angles, and then curve downwards. On the upper surface we see three narrow bands running across the central portion, which represent so many articulations, but no trace of which is visible on the under surface. These articulations are comparatively small, with the exception of the fourth, which composes the enormous lateral expansion, these, in fact, being nothing more nor less than an excessive development of this division of the body. The last joint is much smaller than this, but is considerably larger than those which precede it.

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* Kroyer says ten; M. Edwards, eleven.

The first four segments give off an equal number of pairs of feet, and the fifth gives attachment to a rudimentary pair, similar in structure to those described in the Cyclopidæ as the fulcra or supports of the ovaries. The extraordinary enlarged lateral bags, or expansions, composing the fourth ring, inclose the intestines, and as Latreille first suggested, in all probability contain a branchial apparatus, similar to that described in the large carapace of the Apus. The chief part of its contents, however, according to Rathke, who has paid such particular attention to this little animal, is the internal ovary. In fact, according to this author, " these appendages are originated by the female organs of generation, which, as they considerably increase in volume, cause the sides of the body to project right and left, like a sac. In each of these lie two organs, differing in size and colour, which may easily be recognised through the integuments, as they shine through them very distinctly. The larger organ is of a rose or crimson colour, and appears, under a low microscopic power, to consist of a pulpy mass. Under a higher power, we become aware that it is formed of an infinite number of roundish, rose-coloured eggs, held together by a colourless, glutinous matter, which forms, no doubt, the envelope of the organs. This rose-coloured organ, then, is the ovary. The other, and much smaller organ, lies under this, on the abdominal wall of the body, is distinguished from the former by a milk-white colour, and presents in general a winding, serpentine canal, of uniform width, which runs along almost to the further blunt extremity of the wing-like appendage, and from thence proceeds in a curve round that part where the appendage proceeds from the body, into the middle portion of the same, and where it evidently has its issue on the same side where the sexual aperture occurs. The latter organ, which is wont to contain a somewhat thickish fluid, is not, apparently, an exudation of the ovary, but something similar to those organs in the Lerneadæ and Cyclopidæ, which, in the formation of these clusters of eggs, give forth a glairish fluid, soluble in water, which I have more minutely described in a treatise on *Dechelesthium sturionis*, and *Lernæopoda stellata*, and have called it the cementing organ."[*]

The intestine is a simple canal, which does not show any appearance of an enlargement indicating a stomach. In the fifth segment we find the two openings of the sexual apparatus.

The feet are very small, and the first four pairs are all alike, consisting of a basal joint of comparatively large size, and two branches, each composed of three short articulations, furnished with tolerably long setæ. The fifth, or rudimentary pair of feet, is extremely small. It is formed of two somewhat compressed joints, of nearly equal length, the terminal one being provided with five pretty long bristles.

The abdomen is slender, and is divided into five joints, which become gradually smaller as they succeed each other. The last is slightly lobed at the extremity, and sends off two long, thick, simple setæ or bristles, and several very much thinner and shorter ones.

The external ovaries are very large, of an oval shape, of a rosy colour, and contain a very great number of ova. They take their origin from the fifth ring of the thorax, where the opening of the sexual organs has been already described to exist.

The Nicothoe is found attached, often in considerable numbers, to the gills of the common lobster. The animals plunge themselves deeply amongst the filaments of which these organs are composed, and remain so firmly fixed to the spot where they attach themselves, that no efforts can make them move. "They allowed themselves," says M. Edwards, "to be torn to pieces, without making the least movement, or quitting their hold. Plunged into fresh-distilled water they were soon killed, but did not fall off, and when the piece of gill putrefied, they putrefied along with it, without their ever making any motion. When plunged into spirits of wine, they made no movement of contraction visible, even when examined by means of the microscope. Taken carefully off, with all possible precautions not to injure the animals, and placed in a glass of sea-water, though watched for several hours, and though they lived during that period, as might be seen from the peristaltic movement of the intestine, they made no attempts themselves at locomotion."*

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[*] Nov. Act. Ces. Acad. Nat. Cur., xx, 102, 1843.

The males have never yet been observed, but in all probability, as the animals of this genus approach so much in their habits to those of the Lerneadæ, they are, as in them, very small, unattached, and capable of moving freely about in the gill-cavity, or attaching themselves to the females.

All the specimens yet observed have had the wing-shaped appendages, and invariably, when of a large size, have had the external ovaries suspended from the body, and full of eggs. These are spherical in shape, and of a very pretty rose colour. After the egg has made some progress, it assumes the appearance of a somewhat irregular oval, a little flattened on its sides, on each of which a pair of limb-like knobs or excrescences are visible, situated at a little distance from each other. The front pair most probably become antennæ, and the posterior, foot-jaws.

A very curious circumstance has been observed by Rathke, with regard to the further development of these ova into the larva state. In such creatures it is extremely difficult to trace their full development up to maturity; but Rathke has observed that the young of the Nicothoe are considerably advanced in development before they leave the ovary, and that while there, some of these embryos attain a considerably larger size than others, and pursue a somewhat different progress. The one, the larger kind, Rathke considers may be the female, and the smaller the male, though he confesses that the smaller form is the most abundant in the ovaries. The larger embryo has a flat appearance, and consists of a very large and broad upper portion or cephalo-thorax, and a narrow posterior portion, nearly of the same length as the upper. The upper part, or cephalo-thorax, is rounded and narrower in front, much expanded laterally, and contracts again posteriorly. On the upper part of the dorsal surface, situated near the edges, we see two light, reddish-brown points, one on each side, which are no doubt the eyes; while it is equally clear, the large lateral expansions become the wing-shaped appendages in the adult.

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* Ann. Sc. Nat., ix.

On the ventral surface we see, at the upper part, two antennæ of considerable size, consisting of three stout articulations; and a little below these organs we see a pair of short members, of one joint, forming pretty strong hooks or curved claws, which are no doubt the first pair of foot-jaws. Between these organs we find, exactly in the centre, a small protuberance, representing the organs of the mouth; and at some distance below this we see two other pairs of members, the first of which consists of two joints, the basal, stout and of considerable size, the terminal much smaller, and ending in a strong hook-shaped claw. The second pair is much larger, and is formed of three articulations, the middle one the longest, and the terminal armed at the extremity with a stout claw. These two pairs of organs are the second and third pairs of foot-jaws in the adult. A little lower still, close to the posterior margin of the cephalo-thorax, we see another pair of members, flat and of considerable length. They consist of three joints, the terminal one being provided at its extremity with several short setæ.

The inferior half of the body of the animal is composed of four segments, the first of which is the largest, and has on its ventral surface a pair of members exactly similar to the last pair described, belonging to the cephalo-thorax. The other segments decrease in size as they descend, and the last is slightly lobed at the extremity, and furnished with several setæ.

The smaller of the two forms of embryo differs in the shape as well as the size of the cephalo-thoracic portion, being ovate, the superior portion broader than the inferior, and not expanded laterally. The lower half of the body is narrower than the corresponding portion of the first form, but consists of the same number of segments.

The eyes and antennæ are similar, but the latter organs are proportionally larger.

The foot-jaws are either wanting or so rudimentary as not to have been observed, while the last two pairs of members are narrower and shorter than those in the first form.

In general conformation we thus find the young of the Nicothoe very similar to the young of the Cyclops, and we can trace the gradual transformation of the different parts of which the animal is composed. The eyes, mouth, antennæ, and three pairs of foot-jaws already exist, though in their progress towards maturity they undergo considerable changes. We find, however, only two pairs of swimming-feet, while in the adult there are five. The two upper pairs become smaller, but assume a branched form, and the three others are added during the animal's progress towards maturity. The whole body consists, in the young, of five segments, in the adult of ten; five rings are thus added during its growth, before it reaches the full-grown state.

In general form, the Ergasilidæ appear to connect the Cyclopidæ with the Lerneadæ; but in habits and mode of life they approach more closely to this latter order than any other family of the Siphonostoma.

1. Nicothoe astaci. Tab. XXXIII, fig. 11.

Nicothoe astaci, *Audouin and M. Edwards,* Ann. Sc. Nat., 1st series, ix, t. 49, f. 1-9.
— *Latreille*, Cuv. Règne Anim., iv, 202.
— *Burmeister*, Nov. Act. Nat. Cur., xvii, 327.
— *Guerin*, Icon. Règne An. Crust., t. 35, f. 12.
— *Kroyer*, Tidsskrift, ii, t. 3, f. 7.
— *M. Edwards*, Hist. Nat. Crust., iii, 481, t. 40, f. 23.
— *Rathke*, Nov. Act. Nat. Cur., xx, 102, t. 5, f. 1-10.

Character.—The length of this species is about two lines, and the colour is of a rosy hue. It is as yet the only known species of the genus.

Hab.—On the gills of the common lobster. London market, March and April, 1849; W. B. Falmouth, Sept. 1849; W. P. Cocks, Esq. British Museum.

Order II—LERNEADÆ.

Mouth suctorial. Thorax not articulated. Feet and other organs belonging to thoracic segment nearly rudimentary. No eyes. Body very *outré* in appearance.

Bibliographical History and Systematic Arrangement.—The existence of the Lerneæ seems to have been known to the ancients. Aristotle informs us, in his 'Historia Animalium,' that the tunny and sword-fish are tormented by a sort of worm, which fastens itself under the fin, and causes such irritation to the animal, that it often leaps out of the water, and falls on board of ships.* Pliny repeats the assertion almost in the words of Aristotle.* Oppianus, in his poem 'Alieuticon,' describes the sufferings of the poor tunny and sword-fish in moving language, and asserts that the fish are frequently killed by their pigmy assailants.† Athenæus repeats what his predecessors have written before him; and Salvianus, in his 'Aquatilium Animalium Historia,' 1554, quotes at length the passages bearing upon the subject from Aristotle, Pliny, Oppianus, and Athenæus.‡ Rondeletius, in his 'Libri de Piscibus marinis,' 1554, repeats, for the sixth time, Aristotle's and Pliny's accounts of this parasite of the tunny and sword-fish, and to prove his personal knowledge of the little animal in question, gives a figure of a tunny, with the parasite attached, near the pectoral fin.§ He says it adheres so tenaciously, that it cannot be shook off by any agitation of the body of its host.

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* "Thunni et gladii agitantur asilo canis exortu, habent enim utrique per id tempus sub pinna ceu vermiculum, quem asilum vocant, effigie scorpionis, magnitudine aranei; infestat hoc tanto dolore, ut non minus interdum gladius quam delphinus exiliat, unde fit, ut vel in navigia sæpenumero incidat."—Lib. viii, cap. 19.

Conrad Gesner, in his 'Historia Animalium—De Aquatilibus,' 1558, enters largely into the history of this parasite. He describes its structure and appearance, "because," he says, "few people know what this parasite is, as it is very small, seldom to be seen, except at the time of the rising of the dog-star, and then not on many fishes, but only on the tunny, sword-fish, and occasionally the dolphin (and not even on every individual)." He gives a figure of it slightly magnified,* and repeats the representation of it *in situ* on the tunny,† as previously given by Rondeletius. "It adheres so firmly," he remarks, "that it cannot be removed without tearing it. It sucks the blood of the fish, like as the leech does, till it falls off through very fulness, and then dies." On this account these fishes (the tunny especially is mentioned) are poor and bad during the height of summer, though, owing to their being so sadly tormented by these plagues, they are more easily caught at that time than they are in winter, at which time they are in better condition.‡ The specimen he describes as having examined himself was, he says, of a white colour, and was found adhering "ad piscem Pagrum."

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* "Animal est parvum, scorpionis effigie, aranei magnitudine. Hoc se, et thynno, et ei qui gladius vocatur, crebro delphini magnitudine excedenti, sub pinna affigit aculeo, tantique infestat dolore, ut in naves sæpenumero exiliant. Quod et alias faciunt aliorum vim timentes, mugiles maxime, tam præcipuæ velocitatis, ut transversa navigia interim superjactent."—Hist. Nat., lib. ix, cap. 16.

† "Dum canis ardenti turbatur sydere cælum
Et thynni et gladii diro vexantur asilo:
Qui fixus madidis illos contundit in alis,
Non arcere queunt, non hanc propellere pestem,
Incutit hoc celeres vires, stimulosque feroces
Concitat; armantur rabie, furuentque dolore:
Invitosque agitat pestis furibunda natantes:
Exhorret vulnus, bacchantur in æquore lata.
Hi torti stimulis incursant navibus altis:
Et sæpe in terram saliunt e gurgite vasto,
In tanto volvunt luctantu membra dolore,
Et vitam in tanto mutant cum morte furore."
Alieuticon, traduct. Laurent. Lippio, liber xi, p. 24.

‡ Pp. 126-8.

§ P. 249.

Pernetty, in his 'Histoire d'un Voyage aux Iles Malouines, fait en 1763-4,' published at Paris in 1770, found apparently the same species adhering to a tunny, and gives a figure of it, which seems to represent pretty nearly the animal delineated by Gesner.

More recently, M. de Blainville, in the 'Journal de Physique,' xcv, 1822, has figured, from a MS drawing of M. Marion de Procé, a similar species, which he has called *Lerneomyzon incisa*, and which I have no doubt is the οἰστρος, or *Asilus marinus* of Aristotle, Pliny, Rondeletius, and Gesner, and nearly identical with the animal figured by Pernetty.

Boccone, a Sicilian gentleman, in his 'Recherches et Observations naturelles,' published at Amsterdam in 1674, informs us, that at Messina his attention was called by M. Scilla, a famous painter and antiquary of that town, to the fact that the *Xiphias*, or sword-fish, was well known to the fishermen on the coast to be tormented by a parasite which they called Sanguisuca. The only information he received was that the motion of the creature was like that of a gimlet in plunging itself into the flesh of the fish. He succeeded, however, in obtaining a specimen, which he describes and figures.* They bury, he says, their whole head or trunk in the flesh of the sword-fish. They are not generally confined to one part of the body, but always on such places as that the fin of the animal cannot reach them. Boccone refers this species to the Oistros, or *Asilus marinus* of Gesner, &c., and says that no figure is given of it by Gesner, or any of the authors who take notice of it. In this, however, as I have shown above, he was mistaken; and had he observed the figures given by Gesner and Rondeletius, he would not have made the mistake of asserting the two species to be identical.† Its being found upon the Xiphias, or sword-fish, no doubt was the cause of the mistake. He makes, however, a very curious observation in connexion with this parasite. "This sangsue," he says, "appears to be tormented by a louse which I have never seen on any other animal. It is of the size of a pea, and attaches itself firmly to the animal," p. 292.

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* P. 112, figure annexed.
† P. 1152, figure annexed.
‡ Pp. 112, 113.

Gesner, in quoting Aristotle's description of the Asilus, had already observed, "adeo nihil est quod hoste careat" (p. 112), a remark well illustrated by the little fact just mentioned by Boccone.‡

Muraltus, in the 'Miscellanea curiosa sive Ephemeridum Medico Physicarum Germanicarum Academiæ Naturæ Curiosorum,' published at Nuremberg in 1682, mentions that while dissecting a specimen of the *Mustela fluviatilis*, he found an insect inserted into the eye of the fish, and hanging out from it. It was so firmly fixed in the eye by the arms, that no doubt, he says, these animals caused the humours of the eye to escape, and thus rendered the fish blind.* Baker, in the 'Philosophical Transactions' for 1744, vol. xliii, describes a somewhat similar "new discovered sea-insect," which he calls "the eye-sucker," and which he found "fixed by the snout" to the eyes of sprats. The figure is very poorly executed, so much so, that it is not possible exactly to make out the species; but a Lernea does infest the common sprat of this country, and has been figured by Mr. J. Sowerby in the 'British Miscellany.' †

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* Recherches et Observations, p. 284, et sequent. tab., p. 287.

† This animal is a species of Penella, or Pennatula, Linn.

‡ Some fleas there are that live on men,
And these have fleas on them again;
Large fleas have lesser ones that bite 'em,
Thus fleas eat fleas *ad infinitum!*

In 1746 Linnæus, in his 'Fauna Suecica,' first edition, described a parasitic animal found upon the *Cyprinus Carassius*, "whose blood it sucks." He established from this species the genus Lernea. In his 'Iter Wast Gotha,' 1747, he notices another species found on the gills of a species of *Gadus;* and in his second edition of the 'Fauna Suec.,' 1761, he adds a third, as inhabiting the gills of the salmon, which had been figured and described by Gisler, in the 'Act. Holmens.' (Kongl. Vetensk. Handling.) for 1751, under the name of *Pediculus salmonis.*‡ In the 'Syst. Nat.,' 12th edition, 1766, he adds a fourth species to the list, and up to that time these four constituted all that Linnæus admitted into the genus Lernea—a genus which, since his time, notwithstanding the difficulties attending its investigation, has increased a hundredfold, and now constitutes a large family. So *bizarre* in appearance are these Lerneæ, that Linnæus had no idea that they belonged to the Crustacea; on the contrary, he places them amongst the worms.

"Of all the curious creatures which the naturalist meets with in his researches," says Dr. Johnston, "there are none more paradoxical than the Lerneæ; none which are more at variance with our notions of animal conformation, and which exhibit less of that decent proportion between a body and its members which constitutes what we choose to call symmetry or beauty."§ It is no wonder, then, that with the scanty knowledge he had of their habits and history, Linnæus should have considered their proper place in the system of nature to be amongst his Mollusca; animals belonging to his class Vermes, and characterised by him, from the softness of their body and the want of a shell. The various editors and continuators of Linnæus, and most systematic writers, up to a late date, have more or less strictly followed his arrangement. Both Bruguière, in the 'Encyc. méthod.,' 1792, and Blumenbach, in his 'Handbuch,' 1779, have adopted his place for them in their systematic arrangement. Cuvier, in his 'Tableau élémentaire,' 1798, arranges them amongst the *Mollusca gasteropoda*, placing them along with those which have free motion in the water. Lamarck, in his 'Système des Anim. sans Vertèb.,' 1801, likewise fixes them amongst the Mollusca, arranging them with the naked *Mollusques cephalés*. Bosc also admits them among the Mollusca; but observes that they approach the intestinal worms. Lamarck, dissatisfied with his first arrangement, afterwards, in his 'Philosophie Zoologique,' 1809, removes them to the Annelides, placing them along with the Planariæ and Leeches. Still later, in his 'Extrait du Cours de Zoologie,' 1812, he indicates the necessity of forming a distinct class to receive them, which he calls Epizoaires, a series of animals which he could not refer exactly to any of the already determined classes of the animal kingdom; and in the 'Hist. Nat. Anim. sans Vertèb.,' first edition, 1816, in placing them amongst the Epizoaria, he says, "these animals approach near to worms and to insects, without belonging to either. They indicate the existence of a particular series, which may probably form a new class, and which may properly fill up the great void which exists between insects and worms." Of this little group he adds, "I only at present make a simple provisional indication."

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* Decuria, ii, p. 126.

† The *Lerneonema monillaris*, M. Edwards.

‡ Act. Holmens., 1751, p. 181, t. 6, f. 1-5.

§ Loudon's Magazine of Natural History, viii, 565.

Oken, in 1815, in his 'Lehrbuch der Naturgeschichte,' following Linnæus in placing the Lerneæ amongst the Mollusca, was the first who commenced dividing them into different generic groups. De Blainville informs us, that a year or two before that, in 1814, during a journey to England, he had been led to see the necessity of separating them into different genera also; but that he was induced to assign them a place amongst the Entomozoa, or articulated animals, viewing them, he says, "as an anomalous group of worms." He acknowledged, as Oken had done, the relations which evidently existed between them and the Caligidæ, but still did not incline to refer them to the Crustacea. This view of these curious animals he published in 1816, in his 'Prodromus de Classification nouv. du Règne Anim.,' without at the time being aware what Oken had previously done.

In 1817 Cuvier adopted the view taken by Bosc, and in his 'Règne Animal' placed the Lerneæ amongst the intestinal worms. There is nothing very instructive in this detail of the difficulties felt by systematic writers in knowing or determining where these curious, and at first sight *bizarre*-looking animals should be placed. Little was known of their habits, manners, or mode of propagation, and though as we have seen, their near relations with the Caligi had been observed by several authors, they had not sought to resolve the question by deeper anatomical researches, or investigations into their mode of life and habits. Their true position, however, was soon about to be ascertained. Soon after Cuvier had published the first edition of his celebrated work, the 'Règne Animal,' a French physician at Havre, M. Surriray, made the important discovery that the ova were contained in the long filaments suspended from the abdomen, and that the young, when born, bore no resemblance to their parent, but on the contrary were extremely similar to the young of the Cyclops. De Blainville recorded the fact in the 'Journal de Physique,' 1822, in his excellent article, "Lernea," and fully admitted the truth of Surriray's statement. In this article he remarks the near approach of his last genus among the Lerneadæ to the last of the Caligidæ, and traced the almost insensible gradations by which we are carried from that genus to the Caligus itself, thence to Argulus, and through it to the Apus and other Branchiopods. He still retained them, however, amongst the Epizoa; and Desmarest, in his 'Cons. gén. sur la Classe des Crust.,' 1825, appears to have been the first to distinctly refer them, as a group, to the class Crustacea.*

In 1826, MM. Audouin and Milne Edwards discovered a parasite upon the Astacus, or lobster, the Nicothoe,† and in the course of their observations upon the history of this curious Siphonostome they came to the conclusion, reasoning from analogy, that the Lerneæ were real Crustacea, that "became monstrous after they had fixed themselves" upon the animal which was to serve them with nourishment.

Kroyer informs us that several German zoologists, as Nitsch, Leuckart, and Schwegger, had advanced similar opinions, though, it would appear from his references to their observations, upon very insufficient grounds. Zoologists, however, were gradually coming to the conclusion that these fantastically-formed creatures were in reality crustaceous. But it is to Alexander von Nordmann, an eminent Prussian naturalist, that we are indebted for a complete and satisfactory solution of our doubts upon the subject. In his work, 'Mikrographische Beitrage zur Naturgeschichte der Wirbellosen Thiere,' Berlin 1832, he has confirmed the observations of Surriray upon the young when first hatched from the ova, shown the dissimilarity which exists between the male and female, and thrown much light upon the anatomy of this interesting group of animals, especially with regard to the structure of their mouth and feet. Since the publication of his excellent work, his observations have received still further confirmation, additions and corrections, by three zoologists of considerable reputation, the well-known entomologist

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* Cons. gén. sur la Classe des Crustacés, p. 343, note.

† See above, p. 300.

Burmeister;[*] an Austrian naturalist, Vincenz Kollar;[†] and the acute observer Rathke.[‡]

Cuvier, in a note in the second edition of his 'Règne Animal,' 1830, p. 256, seems to have been somewhat staggered in his opinion as to the proper place in the system in which the Lerneæ should be placed. The difficulty with him, as to referring them to the Crustacea, seems, from this note, to have depended upon the males not having as yet been observed. Speaking of MM. Audouin and Milne Edwards's opinion as to their being crustaceous, he says, "pour conserver cette opinion, il faudrait pouvoir retrouver ces mâles." Had Nordmann's discovery of the existence of the males been known to Cuvier, in all probability the Lerneæ would not have remained, as they now do, amongst his intestinal worms.

In 1837 Kroyer published, in his 'Tidsskrift,' vol. i, a very excellent paper upon the Natural History of *Parasitical Crustacea*, to which I am much indebted for many particulars with regard to their economy and habits. And since then, M. Rathke, in vol. xx of the 'Nov. Act. Acad. Cæs.' 1843, has still further illustrated many points of the anatomy, habits, and manners, of some of the animals belonging to this group.

In this short bibliographical sketch I have not enumerated many original observers of Lerneæ after the time of Linnæus; however, their number is considerable. Ström, in the 'Physiske og Oeconomisk,' 1762; Ellis, in the 'Philosoph. Trans.,' liii; Fabricius, in the 'Fauna Grœnlandica,' 1780; Müller, in the 'Zoologia Danica,' 1781; Hermann, in the 'Naturforscher,' xix, 1783; Schrank, in his 'Voyage en Bohême,' 1786; Lamartinière, in the 'Journal de Physique,' 1787, and in the Atlas of the 'Voyage of La Pérouse;' Holten, in the 'Acta Danica,' v, 1799; De la Roche, in the 'Bulletin de la Soc. Philomath.,' 1811; Chamisso and Eysenhardt, in the

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[*] Nov. Act. Acad. Cæsar. Nat. Cur., xvii, th. i.

[†] Annal. der Wiener Museums, i, abth. i.

[‡] Nov. Act. Nat. Cur., xx.

'Nov. Act. Acad. Nat. Cur.,' 1821; Mayor, in the 'Nouv. Bull. de la Soc. Philomath.,' 1824; Lesueur, in the 'Journal of the Acad. of Nat. Sc. of Philadelphia,' 1824; Scoresby, in his 'Arctic Regions, 1820;' Grant, in Brewster's 'Edin. Journal of Science,' 1827; Retzius, in the 'Kongl. Vitensk. Acad. Handling., 1829; Johnston, in Loudon's 'Mag. of Nat. Hist.,' 1836, and various other naturalists, have all added more or less to our information, and extended our knowledge of the species of these animals; while M. Edwards, in his 'Hist. Nat. Crust.,' has collected all the species together, and arranged them in their respective families and genera.

Anatomy and Physiology, &c.—The form of the animals belonging to the Lerneadæ is very variable. "Respecting this," says Kroyer,* "it is not easy to say anything general. The remark only forces itself upon every observer, that the exterior of these animals is often so highly fantastical, that we are disposed to admire the freaks of nature in bringing forth such forms. But it is evident, that when continued observations and investigations have put us in possession of the condition of these forms, we shall see here, as everywhere else, that singularity resolves itself into regularity."

For the most part the skin, or external envelope, is soft and flexible, but there are many species in which it is somewhat of a cartilaginous consistence. Nordmann has discovered that it consists of a threefold structure; an external layer, tolerably firm and elastic; next, a very loose and soft cellular tissue; and finally, a third layer, composed of a number of muscular fibres crossing each other in length and breadth, and having, in consequence, a reticulated appearance.

We can generally trace, more or less distinctly, a division of the body into two parts; the first of which, the smaller of the two, forms the head, and the other the thorax. This latter is generally of considerable size, whilst the abdomen, in almost all the species, has become very nearly rudimentary. Attached to the head, in the greater number of the Lerneadæ, we find one pair of antennæ, and two pairs of foot-jaws, by means of which they attach themselves to their prey. In a few we find no antennæ, and only one pair of foot-jaws. We find no appearance of eyes. The organs corresponding to the thoracic feet of the Siphonostoma are variable in form, but in general are almost rudimentary, sometimes, indeed, altogether wanting. It is this very rudimentary state of the organs of motion and other appendages that forms the principal mark of distinction between the Lerneadæ and the Siphonostoma. The mouth, according to Kroyer, has generally the shape of a blunt, spherical snout, placed on the most advanced portion of the head, and terminating in a roundish opening, though in some of the genera it is in the form of a slight elevation merely, and is placed at a considerable distance from the anterior part of the head.

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* Tidsskrift, p. 171.

The manner in which these animals fasten themselves to the fishes upon which they live varies much. In some, it is by means of the foot-jaws alone, which in these species are strong, and of a hooked form. In others, it is by means of two long appendages springing from the upper part of the thorax, one on each side, and uniting at the tip, forming at their junction a sort of round button. In a third set, again, the organs of attachment are a series of horns or appendages proceeding from the side of the head.

The females are generally furnished with large external ovaries, containing numerous ova. The intestinal canal is very distinct, extending through the whole body. It is cylindrical, and widens towards the middle of its length into a stomach. The motion in the living individuals may be plainly seen, a series of rhythmical movements to both sides, occurring to the number of from about sixty to sixty-five in the minute; besides a sort of peristaltic motion, or an alternate contracting and lengthening itself upwards and downwards.

Nordmann has described what he considers may be the liver and brain, and has pointed out the heart. This latter organ contracts and expands regularly, but no blood-vessels are to be seen, the blood flowing freely about in the hollow of the body and arms. The blood is a clear, watery-like fluid, composed of three kinds of globules, differing in form and dimensions. The internal ovaries lie on each side of the intestinal canal, and open by means of a canalis deferens on each side of the inferior portion of the thorax, where the external ovaries take their origin.

In general, it is only the adult female of the Lerneadæ that we are in the habit of observing, and in an animal whose organs of motion and perception for the most part are merely rudimentary, and whose existence is strictly stationary, the manner of life must be very simple. Immoveably fixed upon the fish which serves it for food, its existence depending upon the life of its host, it requires neither feet to transport it from place to place, nor eyes to guide it in its search for fresh abodes. In fact, the whole of its active existence consists in the two operations of taking food, and propagating its species. We find them in all instances more or less deeply fixed in the tissue of the parts upon which they have taken up their habitation, and often so deeply lodged, that little else but the oviferous tubes are visible externally. There they remain, living at the expense of their host, those that inhabit the branchiæ or are deeply fixed in the soft tissue of the bodies, drinking up the blood; and the others which are fixed less deeply, and take up their abode under the fins and such places, sucking the slimy juices of the skin. As they are never seen to change their place of residence, the question naturally occurs—how did they come there originally? Having no feet to propel them through the water, and no eyes to guide them, even if they possessed the faculty of transporting themselves from one place to another, how is it that we thus find them fixed upon these fishes, mature and possessing ova? Blainville answers this question, by saying, "it is difficult to conceive how these animals, which spring from eggs, are fixed upon fishes without admitting that in their young age they possess a little motion." M. Surriray had at that time demonstrated to Blainville the existence of the young when just hatched; but less importance was attached to this discovery than it deserved; and it was not till Nordmann corroborated the fact, and followed it up by his more patient researches, that we were enabled to answer the question fully.

The circumstance that the Lerneadæ soon die after being taken from the fish that has served them for nourishment and a habitation, certainly throws great difficulty in our way of observing the development of the young; but we now know that when hatched, and for some time afterwards, the young Lerneadæ are nimble and active, and possess both the organs of motion and the faculty of using them. When they first come out of the egg they are of an oval shape, and very much resemble the young of the Cyclopidæ. They possess a large eye, situated in the centre of the anterior and upper part of the body, and are provided with two large pairs of swimming-feet, and a pair of jointed antennæ. As in the Cyclopidæ, these young Lerneadæ cast their skin repeatedly before they arrive at maturity. After the first moulting, the body is seen plainly divided into two parts, the anterior of which is furnished with three pairs of hooked feet, and the posterior with two pairs of swimming-feet. No doubt there are a good many stages of development to go through before they assume the mature form, but it has not yet been possible to follow them out. It is not the least curious part of the history of these singular-looking animals, that the young should thus stand on a higher stage of development than the mother! and that their progress from youth to maturity should be in the directly opposite ratio to that of all the other Crustacea. At what period of their existence they fasten themselves upon their prey is at present unknown; but no sooner apparently does this happen than the eye disappears, and the feet either disappear also, or are transformed into other organs. In some they are changed into foot-jaws, by means of which they fix themselves upon the body of the fish they select for their habitation. In others they are transformed into long and strong prolongations like arms, which unite together either at the tips only, or from the roots all the way up to the point, where they send forth a short horny stem, that widens into the shape of a round button, and which, when buried in the skin or flesh of the fish, forms such a strong attachment, that the Lerneadæ cannot be detached without being torn, or by being carefully dissected out. Most probably the species in which this development takes place first fasten themselves to their foster-mother by the foot-jaws, as the first-mentioned set do, and after being buried in the flesh, these organs assume this peculiar formation, otherwise it is difficult to conceive how such an instrument could penetrate deeply into the body of the fish. A third mode of transformation of the feet appears to be into a series of horny branchlets developed round the mouth, and which, when they have penetrated deeply into the soft parts of their host, serve effectually to retain the parasite in its place. The adult Lerneadæ show, with the exception of taking food and laying eggs, very few and feeble signs of life, whether attached to the nourishing animal or when separated from it. Many of the genera show no external signs of life at all after separation from their foster-mother; others move their jaws for a short period, or their head may be seen to move leisurely in different directions for a little time and then cease. In one species (*L. branchialis*), Kroyer tells us, that he observed a singular phenomenon that nobody else had before noticed. When he touched an individual, it squirted, he says, "from the vent, a transparent stream of fluid to the distance of a foot and a half, and this it repeated several times one after another."

That part of the history of the Lerneadæ which is connected with their sexual relations and propagation is still involved in much obscurity. But the details we have received from Nordmann and Kroyer, with regard to the males, are no less singular than many of the other curious parts of the history of these animals. By some of the earlier observers it was supposed that those individuals which had not oviferous tubes were males, while others imagined that they were hermaphrodites. Neither of these opinions, however, will stand the test of inquiry. The ovaries of the female, after the eggs have attained maturity, burst and disappear, and thus, as Kroyer observes, "the Lernea which to-day was considered a female, to-morrow might be regarded as a male." In the course of investigating different species of Lerneadæ, Nordmann discovered, in several instances, small bodies adhering to the generative organs of the females, which, on closer inspection, proved to be animals that differed very much in appearance from the female, and, on the contrary, bore considerable resemblance to the young ones in the first stage of their development. These he believed were the males, and though Burmeister has thrown great doubts as to the entire accuracy of Nordmann's observations, his statements as to the fact of these animals being males are borne out by Kroyer and others. It is probable, as Nordmann remarks, "that the males and females are mixed together when they come out of the eggs, but that they develope themselves differently at the last change of skin." They continue to show uniformity in regard to the form of the head, and the form and situation of the parts connected with it, but they want the apparatus for attaching themselves which the females possess, having instead, two pairs of strong, hooked feet. They differ constantly in the form of the other parts of the body, and show a remarkable diversity from the female with respect to size, being very much smaller. These males bear a strong resemblance to each other, even in different genera, in which the females are very unlike. This fact and the preceding, viz. the great difference of size, have been considered by Burmeister as strong objections to the truth of Nordmann's conclusions. It is true many experiments and careful anatomical investigations are still wanting to establish conclusively the facts as stated by Nordmann, but still the observations made by him upon one or two genera leave little room to doubt the truth of the opinion as regards these individuals at least. Kroyer considers that the Lerneadæ are at a very early age capable of breeding, though it is not yet known at what stage of development exactly they become so. Certain it is we see, in small specimens of some of these animals, small ovaries and a few eggs contained in them, whilst as the females increase in size the ovaries become larger, and the eggs more numerous. Burmeister affirms that the Lerneadæ only propagate once, and the ovary continues to increase in size, and the eggs to increase in number, till they become mature, and that then the parent Lernea has played her part. Kroyer doubts this; and the opposite opinion holds better with the analogy of the other Entomostracous Crustacea. But upon this point direct experiments are wanting.

The animals belonging to the Lerneadæ have been divided by M. Edwards into three families, according to the manner in which they become fixed to their prey. Some, as I have already mentioned, are attached by means of the head itself, which is furnished with one or more pairs of horn-shaped appendages projecting laterally; others by means of long arm-shaped appendages springing from the thorax, united to each other at the tip, and terminating in a horny button in the centre; a third set again are fixed by the aid of stout foot-jaws, armed with strong hooks. These characters afford good marks of distinction, and I propose naming them accordingly:

The first set are the Anchoraceracea;
The second are the Anchoracarpacea;
And the third are the Anchorastomacea.

TRIBE 1—*ANCHORASTOMACEA.**

CHONDRACANTHIENS, *M. Edwards,* Hist. Nat. Crust., iii, 491.

Character—Females. Attached to their prey by means of their foot-jaws, which are stout and armed with strong hooks. One pair of antennæ; generally very distinct. Thoracic feet nearly rudimentary, or represented by appendages of considerable size, but differing in form from ordinary feet.

Males. Free and unattached; very small and differing totally in appearance from the females.

Family CHONDRACANTHIDÆ.

CHONDRACANTHIENS (*pars*), *M. Edwards.*

Character.—Organs representing thoracic feet, in form of considerable-sized, cartilaginous-looking, not articulated appendages; generally three pairs in number. Three pairs of foot-jaws.

Bibliographical History.—Linnæus, in his 'Wastogota Resa,' or tour through Westrogotha in 1747, describes a species of Lernea, which he afterwards named *Lernæa asellina*, that evidently belongs to the family of Chondrocanthidæ. This is the first notice of any species that we have met with, but the figure is too indifferently executed to enable us very distinctly to refer it to any one described. Barbut, in his 'Genera Vermium,' 1703, copies the figure as it is, and mentions it as the Lernea that infests the gills of the cod and ling of the Northern Ocean. Müller, in his 'Zoologia Danica,' 1781, describes and figures three other species infesting the fishes of the Danish seas, two found on soles, and a third on the *Coryphæna rupestris.* Delaroche, in the 'Nouv. Bull. des Sc. de la Soc. Philom.,' 1811, describes another species, and first gave to it the name of Chondracanthus, from the cartilaginous sort of spines which cover the body.

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* Αγκυρα, anchor; and στομα, mouth.

Cuvier, in his 'Règne Animal,' figures two distinct species, but only slightly indicates them in a note; and Blainville, in his Monograph of the Lerneadæ, in the 'Journ. de Phys.' for 1822, describes nine more, under the different generic names of Lernacantha, Lernentoma, and Lernanthropus. None of these authors, however, enter into any lengthened details with regard to the structure or habits of these curious little creatures; but a few years after the publication of Blainville's memoir, attention was called to their history by Nordmann, who, in his 'Mikrog. Beitr.,' 1832, has given us much very interesting and valuable information with regard to them. He was followed by Burmeister and Kroyer, the latter of whom has especially devoted his attention to the anatomy and physiology of several species of the family. Since then, Rathke has followed up these inquiries with great diligence, and has added much to our knowledge of the two sexes, as well as the internal anatomy of the female.

Anatomy, &c.—Female. The body of these animals presents no trace of articulations, though two or three divisions may in general be easily recognised, consisting of the head, which has in many instances a sort of neck, and the thorax. The abdomen is nearly quite rudimentary. The head is small, and generally not very distinct from the body. It is slightly convex and smooth dorsally, and has a small groove running down the centre. In many of the species it contracts towards its lower part, forming a short neck before it joins the thorax.

The eyes are totally wanting. The antennæ are only one pair, rather flattened generally, and very indistinctly jointed.

Immediately beneath the antennæ we see the first pair of foot-jaws; small, and consisting of a short but stout basal joint, and a hard, curved claw or hook, by means of which the animal assists in fastening itself to its prey. At some distance from these organs, about the middle of the head, is situated the mouth.

Rathke and Nordmann describe a pair of mandibles attached to the mouth, and a pair of small organs, which, according to M. Edwards, is a second pair of foot-jaws. The mandibles are very small, and are beset along their entire length with very fine teeth; and the foot-jaws are somewhat larger, and composed of a stout basal joint and a horny, curved hook. Immediately below these we see a third pair of foot-jaws, considerably larger than the preceding, and consisting of two tolerably large joints, and a moveable, moderately large, and curved claw.

The thorax is connected to the head by means of a sort of neck, which in some species is of considerable length, and occasionally gives origin to one or two pairs of processes, which project laterally. The thorax itself is of considerable size, and varies much in form and appearance; it gives origin to several pairs of cartilaginous-looking processes from its sides, and a pair of ovarian tubes of considerable length. Between these ovarian tubes is situated the abdomen, which is exceedingly small, indeed almost obsolete.

Male. The males are extremely small, about half a line long, and do not in the slightest degree resemble the female. They are of a more or less pyriform shape, with a very large head, an articulated thorax, and possess very large foot-jaws. They are always found attached to the posterior extremity of the female, between the anus and the right sexual aperture.

In general only one male is found upon each female, but in some species there are two. As I have mentioned above (p. 321), doubts have been thrown upon these little creatures being males. Burmeister, for instance, supposes they may be only unformed or youthful specimens. Rathke, however, agrees with Nordmann and Kroyer, in considering them to be really males. "The circumstance," he says, "that those beings which we find in the sexual apertures of the female Lerneæ, show always in the same species the same degree of development and structure, and that in some species, *Chondracanthus Lophii* for example, only a single small specimen is found on each female, and in other species, on the contrary, two small specimens are found in the sexual apertures of a female, sufficient reason may be found to support Nordmann's view, and to establish its truth."

Genus 1—CHONDRACANTHUS.*

CHONDRACANTHUS, *De la Roche,* Nouv. Bull. Soc. Phil., ii, 1811.
— *Lamarck,* Hist. An. s. Vert, edit. 2d, iii, 681.
CHONDRACANTHUS (*pars*), *M. Edwards,* Hist. Nat. Crust., iii.
LERNACANTHA, *Blainville,* Journ. de Phys., xcv, 442, 1822; Dict. Sc. Nat., xxvi.
— *Desmarest,* Cons. gén. Crust., 350.

Character.—Two pairs of foot-jaws prehensile, the third nearly rudimentary. Appendages of thorax representing the feet, in form of digitated, but not articulated, and not setiferous lobes or tubercles. Oviferous tubes very short, broad, and flattened.

The genus Chondracanthus was established by De la Roche in 1811, in the 'Nouv. Bull. de la Soc. Philom.,' upon a species of Lernea which he found attached to the *Zeus faber,* and which appears to be characterised by its exceedingly bizarre appearance, as if it were stuck over with horny spines or tubercles, and having the oviferous tubes short, broad, flattened, and nearly concealed between the elongated, terminating, lateral prolongations.

Blainville, in the 'Journal de Physique,' 1822, in his monograph of the Lerneadæ, established upon the same species his genus Lernacantha; but the name of Chondracanthus has by most succeeding authors continued to be retained.

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* Χονδρος, cartilage; and *ακανθα*, spine.

Chondracanthus Zei. Tab. XXXV, fig. 1.

Chondracanthus Zei, *De la Roche*, Nouv. Bull. des Sc. de la Soc. Philom., ii, 270, t. 2, f. 2, 1811.
— *Lamarck*, Hist. An. s. Vert., iii, 682.
— *Burmeister*, Nov. Act. Nat. Cur., xvii, 325.
— *Guerin*, Icon. Règne Anim. Zooph., t. 9, f. 9.
— *M. Edwards*, Hist. Nat. Crust., iii, 504, No. 7.
Lernacantha Delarochiana, *Blainville*, Journ. Phys., xcv, tab. xxvi, f. 13, 1822.
— *Desmarest*, Cons. gén. Crust., 350.

Body short, and rather thick. Head rounded. Antennæ short, and rather broad. Neck narrow, short. Thorax carrying on the under surface two pairs of small appendages, each consisting of three divisions or fingers, and furnished laterally with three pairs of longer prolongations, of many divisions, the terminal one on each side larger than the others, and embracing the oviferous sacs. The upper part of the thorax is covered with short, conical, sharp-pointed spines. Abdomen rudimentary. Oviferous sacs flattened, containing many small ova.

Hab.—Found adhering to the gills of the *Zeus faber*, by J. Crouch, Esq. "Dr. Leach." British Museum.

Genus 2—Lernentoma.

Lernentoma, *Blainville*, Journ. Phys., 1822.
— *Desmarest*, Cons. gén. sur les Crust.
Anops (*pars*), *Oken*, Lehrbuch der Naturg., 1815.
Entomoda (*pars*), *Lamarck*, Hist. An. s. Vert., iii, 1816.
Lernæa, *Müller*, Zool. Dan.
Chondracanthus (*pars*), *Cuvier*, Règne An., 1817.
— *Nordmann*, Mikr. Beitr.
— *Burmeister*, Nov. Act. Nat. Cur., xvii.
— *Rathke*, Nov. Act., xx.
— *M. Edwards*, Hist. Nat. Crust.

Character.—Foot-jaws and thoracic appendages as in Chondracanthus. Oviferous tubes long, either club-shaped and stout, or slender and twisting.

The genus Lernentoma was first established by Blainville in his monograph of the Lerneadæ, in the 'Journ. Phys.,' 1822, to contain those Lerneæ which, as in Chondracanthus, were distinguished by their having processes or appendages taking the place of the thoracic feet, but having long, club-shaped, oviferous sacs.

Oken, in his 'Lehrbuch der Naturgeschichte,' 1815, had placed the several species belonging to Lernentoma in his genus Anops; but as that genus is loosely characterised by him, and embraces several species belonging not only to different genera, but even to different tribes, I have preferred adopting that of Blainville. Lamarck, in his 'Hist. Nat. An. sans Vert.,' first edition, iii, 1816, places them in his genus Entomoda; but as that genus embraces also several species belonging to different families, though it likewise has the precedence in time, I consider the more restricted and better-defined genus of Blainville as worthy of preference. Most authors, however, have described the various individuals belonging to Lernentoma as Chondracanthi.

1. LERNENTOMA CORNUTA. Tab. XXXV, fig. 2.

LERNÆA CORNUTA, *Müller*, Zool. Dan., i, t. 33, f. 6; Enc. méth., t. 78, f. 1.
ENTOMODA CORNUTA, *Lamarck*, Hist. An. s. Vert., iii, 685.
ANOPS CORNUTA, *Oken*, Lehrbuch der Naturg., iii.
LERNENTOMA CORNUTA, *Blainville*, Journ. Phys., xcv, 441, No. 6.
CHONDRACANTHUS CORNUTUS, *Cuvier*, Règne An., iv, 258.
— *Nordmann*, Mik. Beitr., ii, t. 9, f. 5, 6 (?).
— *M. Edwards*, Hist. Nat. Crust., iii, 500, No. 1.
HORNED LERNÆA, *Shaw*, Naturalist's Miscellany, viii, t. 295.

Character.—Female. Head oval, rather elongated. Antennæ flattened, of considerable size, and projecting. Thorax elongated, club-shaped. Anterior portion narrow for about a third of its length; the other two thirds much broader, and terminating posteriorly in two sharp lateral tubercles of moderate length, and a middle one representing the abdomen, which is nearly quite rudimentary. Two pairs only of thoracic appendages are visible, occurring at the upper portion of the narrow part, each divided into two digitations, and situated at a short distance from each other. The oviferous sacs are of considerable size, cylindrical, and about two thirds the length of the body. Length nearly three lines.

Male. Somewhat pyriform in shape. Head very large, swollen. Thorax conical, divided into five segments, and terminated by a rudimentary abdomen, armed with two small hooks. Antennæ slender, setaceous, projecting from the anterior extremity of the head, and underneath them a pair of hook-shaped foot-jaws. Mouth situated far back, and provided with mandibles; and behind the mouth two other pairs of foot-jaws are visible. Following these we observe two pairs of setiferous tubercles representing the feet. Length, a quarter of a line.

Hab.—Female. On the branchiæ of a sole, May 2d, 1837; Ireland, W. Thompson, Esq.

2. LERNENTOMA ASELLINA. Tab. XXXV, fig. 4.

LERNÆA ASELLINA, *Linnæus,* Faun. Suec., 2101, 1761; Syst. Nat., edit. 12th, i, 1093, No. 4.

LERNENTOMA ASELLINA, *Blainville,* Journ. Phys., xcv, 441.

LERNENTOMA TRIGLA, *Blainville,** l. c., xcv, 441, t. 26, f. 12; Dict. Sc. Nat., xxvi, 125.

— *Desmarest,* Cons. gén. Crust., 349.

CHONDRACANTHUS TRIGLÆ, *Nordmann,* Mik. Beitr., ii, 116, t. 9, f. 1-4.

— *Burmeister,* Nov. Act. Nat. Cur., xvii.

— *Guerin,* Iconog. Règne An. Zooph., t. 9, f. 8.

— *Kroyer,* Tidsskrift, ii, 135, t. 3, f, 3.

— *M. Edwards,* Hist. Nat. Crust., iii, 502.

LERNÆA CAUDA DUPLICI TERETI, *Linnæus,* Wastogota Resa, 171, t. 3, f. 4 *a*, *b*, 1747.

LERNÆA, *Cuvier,* Règne An., iii, t. 15, f. 4.

Character.—Female. Body somewhat square-shaped.

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* Not *Lerneomyzon trigla,* as Kroyer erroneously quotes it (Tidsskrift, ii).

Head small, and situated at the end of a long and slender neck. It is rounded at the anterior extremity, and a little below the antennæ exhibits on each side a round lobe or tubercle. The antennæ and foot-jaws are very small. The neck nearly equals in length the rest of the body. The thorax is broad, and of a somewhat quadrangular shape, with a deep indentation on each side about the middle of its length. On the upper half we see two pairs of prolongations or appendages, each divided into three digitations; and on the lower half there are three smaller appendages, but simple, not digitated. The posterior angles of the thorax are prolonged also into short horns or appendages, which are also simple. The abdomen is in form of a short tubercle, with a rounded blunt point. The oviferous sacs are of about the length of the whole animal, of considerable size, and cylindrical.

The male is similar, according to M. Edwards, to that of *Chondracanthus* (Lernentoma) *cornutus*.

Hab.—It is found attached to the branchiæ of the *Triglæ*. Falmouth, J. Crouch, Esq. British Museum.

3. LERNENTOMA LOPHII. Tab. XXXV, fig. 3.

CHONDRACANTHUS LOPHII, *Johnston*, Loudon's Mag. Nat. Hist., ix, 81, 82, f. 16 *a-c*, 1836.
— *Rathke*,* Nov. Act. Nat. Cur., xx, 116, t. 5, f. 11-18, 1843.
CHONDRACANTHUS GIBBOSUS, *Kroyer*, Tidsskrift, i, 252, t. 2, f. 4.
CHONDRACANTHUS DELAROCHIANA (*pars*), *M. Edwards*, Hist. Nat. Crust., iii.

Character.—Female. Body rather elongate, and somewhat gibbous. Head small, having on each side a small horn-shaped appendage directed a little obliquely backwards. Antennæ small, conical, and slightly curved. Thorax divided into four portions by as many contractions.

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* Rathke has described the same species under the same name as Dr. Johnston has applied to it, but evidently without knowing that the name had already been used.

The first, narrow like a neck, having on the upper portion a short spine, and on the under surface a pair of appendages or prolongations of two divisions or digitations. The second is somewhat quadrilateral, with, on the middle line of the back, two conical tubercles, and on the sides two others, the upper pair the longer; and having on the under surface a pair of appendages of two digitations. The third part is larger than the preceding, and has the same tubercles and prolongations, and in addition, a small spine on the superior portion, and in the mesial line of the under surface. The fourth portion is rather the largest, with two horns or tubercles on the upper surface, a third on the median line of the under surface, and on each side a long terminal prolongation, rather blunt. Abdomen in form of a short tubercle in the centre of the posterior part of thorax. Oviferous tubes very long, slender, and twisted. Length, six lines and a half; breadth, two lines and a half.

The male is very similar to that of the *Chondracanthus cornutus* already described.

Hab.—Found on the *Lophius piscatorius*, in the pouches; Dublin, December 1839. Belfast, November 1841; W. Thompson, Esq. Scotland and coast of Devon, Leach. British Museum. Falmouth, J. Crouch, Esq. British Museum.

TRIBE 2—*ANCHORACARPACEA.**

LERNEOPODIENS, *M. Edwards,* Hist. Nat. Crust., iii.

Character.—Attached to their prey by means of two long appendages which arise from the thorax. They unite together either at the base or near the tip only, and terminate there in a rounded knob like a button, by means of which the animal maintains its hold of the part to which it has attached itself. No thoracic feet, or they are represented by these arm-shaped appendages.

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* Αγκυρα, anchor; and καρπος, arm.

Males in general differ very much in appearance from the females, being greatly smaller and unattached.

Family LERNEOPODADÆ.

LERNEOPODIENS (*pars*), *M. Edwards*, Hist. Nat. Crust., iii.

Character.—Arm-shaped appendages long, wide apart from each other at their base, and united only at the tip.

Genus LERNEOPODA.*

LERNEOPODA, *Blainville*, Journ. Phys., xcv, 442, 1822.
— *Kroyer*, Tidsskrift, i, 207.
— *M. Edwards*, Hist. Nat. Crust., iii, 514.
— *W. Thompson*, Ann. Mag. Nat. Hist., xx, 248.
— *Rathke*, Nov. Act., xix.
LERNÆA, *Gisler*, *Linnæus*, *Grant*, *Retzius*, *&c.*

Character.—Female. Body generally elongated, oval. Head short and thick. Two pairs of foot-jaws, well-developed, and placed near each other. External ovaries of moderate length and cylindrical.

Male. Body divided into two nearly equal portions of an ovoid shape; one representing the head, the other the thorax. Much smaller than the female.

The genus Lerneopoda was established by Blainville, in the 'Journal de Physique,' in 1822; and was afterwards adopted by Nordmann in 1832, Burmeister in 1835, and Kroyer, in his 'Tidsskrift,' in 1837; but the first notice taken of any species appertaining to the genus was by Gisler in 1751, who, in the twelfth volume of the 'Acta Suecica,' describes and figures a species of Lernea found by him on the salmon, and which he called "*Pediculus salmonis* or *Lax-lusen*."†

Linnæus, in his 'Fauna Suecica,' 1761, describes this species as the *Lernæa salmonea*, and repeats it in his

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* Λερναιος, belonging to Lernea; and πους, foot.

† "Salmon louse."

'Syst. Nat.,' 1766. The same little animal was a few years afterwards described as British; the Rev. Charles Cordiner having figured it in 1780, in his 'Antiquities and Scenery of the North of Scotland,' as occurring in the gills of the salmon in the rivers of that country, especially when the fish is "foul."

Another species was afterwards mentioned by the arctic voyager Scoresby, in 1820, adhering to the Greenland shark. Several specimens were taken by him attached to the eye of that animal, and brought home for examination. It buries its arm-shaped appendages in the substance of the eye to the depth of nearly a fourth part of their length, and hangs out externally. The sharks thus attacked seem to be rendered blind by their pigmy assailants. "The sailors," says Captain Scoresby, "imagine this shark is blind, because it pays not the least attention to the presence of a man, and is indeed so apparently stupid, that it never draws back when a blow is aimed at it with a knife or lance." (Arctic Regions, p. 539.) The specimens brought home by Captain Scoresby were ultimately placed in the hands of Dr. Grant, and the species was described by him in Dr. Brewster's 'Edinburgh Journal of Science,' in 1827, under the name of *Lernæa elongata*.

A species was also figured and described by M. Mayor, in the 'Bulletin de la Société Philomathique,' in 1824; and Kroyer, in his 'Tidsskrift,' describes four more new species, and found the male of one, of which he gives a figure.

The young have not yet been seen.

1. Lerneopoda elongata. Tab. XXXV, fig .5.

Lernæa elongata, *Grant*, Brewster's Edinburgh Journ. of Sc., vii, 147, t. 2, f. 5, 1827.
Lerneopoda elongata, *Kroyer*, Tidsskrift, i, t. 2, f. 12, t. 3, f. 3 *a*.
— *M. Edwards*, Hist. Nat. Crust., iii, 515.
The Eye of the Greenland Shark, *Scoresby*, Arctic Regions, i, 538, t. 15, f. 5.

Description.—The head is very distinct, of a horny texture, ovate, depressed, broad at the base, and obtusely pointed in front, resembling very much the shape of the body of the common spider-crab. The second pair of foot-jaws is large and well developed, consisting of a large, rounded, oval, basal joint, and a more slender, curved, hooked, terminal one, with a pretty strong tooth on its inner edge. The head is united to the body by a short, narrow neck. The thorax is long and narrow, of a somewhat club-shaped form, and gives origin to two long cylindrical arms, which considerably exceed the length of the body. At the posterior portion, which is somewhat truncate, we see two small lobes; and on each side of these spring the ovaries, which are about the length of the entire body, thick, straight, and cylindrical.

Length of whole animal, nearly three inches. Head, one line and three quarters. Body, seven lines and a half. Arms, one inch and one line. Ovaries, one inch and one line and a half.

Hab.—A specimen of this arctic species was found attached to the eye of a shark caught on the English coast, and brought to London in the winter of 1848. Mr. Yarrell, to whom I am indebted for the specimen, took it himself from the eye of the shark, but unfortunately it was not perfect. Its arm-shaped appendages were inserted into the cornea, to the depth of nearly a fourth of their length.

2. Lerneopoda galei. Tab. XXXV, fig. 7.

Lerneopoda galei, *Kroyer*, Tidsskrift, i, 272, t. 3, f. 5 *a-f.*
— *M. Edwards*, Hist. Nat. Crust., iii, 516.

Character.—Female. The head is oval, depressed, and of a hard, horny substance. The thorax is long, rather slender, and somewhat cylindrical, narrow where it is attached to the head, and broadest at its posterior extremity. The arms are slender, and nearly the length of the thorax. At the posterior extremity of the body are two small lobes, between which, on the middle line, is a small tubercle, representing the abdomen. Ovarian tubes of moderate length, not quite equal to length of thorax.

Length of the whole body, including arms, about three fourths of an inch.

Male. Body divided into two portions, of an ovoid form, and nearly of equal size. The upper half represents the head, and carries a pair of antennæ, and two pairs of foot-jaws of considerable magnitude. The lower half, representing the thorax, has at its posterior extremity two sub-globular appendages, a little longer than those in the female.

Hab.—Female. Attached to the cavity posterior to the vent of the *Squalus galeus*, Belfast, December 1839, W. Thompson, Esq.

3. Lerneopoda salmonea. Tab. XXXV, fig. 6.

Pediculus salmonis, *Gisler*, Kongl. Svensk. Vetensk. Acad. Hadling., xii, 171, t. 8, f. 1-5, 1751.
Lernæa salmonea, *Linnæus*, Faun. Suec., edit. 2d, 509, No. 2102, 1761; Syst. Nat., edit. 12th, 293; Lernæa, No. 3.
— *Cordiner*, Antiq. and Scen. of the N. of Scotland, 7, 8, t. 6, f. 2.
— *O. Fabricius*, Faun. Grœnl., 337.
— *Müller*, Zool. Dan. Prod., 2744.
Entomoda salmonea, *Lamarck*, Hist. An. s. Vert., edit. 2d, iii, 686.
Lerneopoda salmonea, *Blainville*, Journ. Phys., 1822, 127.
— *Mayor*, Bull. des Sc. Soc. Philom., 1824, 24.
Lerneopoda carpionis (?), *Kroyer*, Tidsskrift, i, t. 2, f. 6.
— *M. Edwards*, Hist. Nat. Crust., iii, 515.

Linnæus's description of this species, as far as it goes, is very good. "Body obovate, thorax obcordate, the two arms linear, approximated." The head is rather small, somewhat bulging out at the back part, broader there, and rather sharp-pointed at the anterior extremity. From the base of the head spring the two arms, which are rounded, and slightly shorter than the body. The thorax is pyriform and short, and at its lower extremity we see two minute eminences. The ovarian tubes are of considerable thickness, cylindrical, and about the same length as the whole animal.

The colour of the animal is white. Length, about half an inch.

Hab.—Gills of the salmon, London market, W. B.

Family 2—ANCHORELLADÆ.

LERNEOPODIENS (*pars*), *M. Edwards*, Hist. Nat. Crust., iii.

Character.—Arm-shaped appendages very short, and united to each other from the base, so as to resemble a single organ.

Genus ANCHORELLA.

LERNÆA, *Ström*, Sondmöer; *Lamarck, Müller, Johnston.*
ANCHORELLA, *Cuvier*, Règne An., 1817; *Nordmann, Burmeister, Kroyer, M. Edwards.*
CLAVELLA (*pars*), *Oken*, Lehrbuch, 1815 (not *Cuvier*, Règne An., nor *Kroyer*).
LERNEOMYZON, *Blainville, Desmarest.*

Character.—Female. Body in general short, and somewhat swollen. Head small, and situated at the extremity of a long neck, which is generally curved backwards. Two pairs of foot-jaws well developed, and a third rudimentary. Antennæ rudimentary. Ovarian tubes of moderate length, and cylindrical.

The male differs in appearance very much from the female, and is very small.

The genus Anchorella, as established by Cuvier in 1817, embraces the Lerneadæ of this division, in which the arms are short, and united to each other from the base. A species is figured by Ström, in the 'Physiske og Oeconomisk,' &c., which appears to be the first described, and which Cuvier has named *Anchorella adunca*. The name of Lerneomyzon was proposed by Blainville, in his Monograph, but the term Anchorella, as having the precedence in time, has been generally adopted by succeeding authors.

1. Anchorella uncinata. Tab. XXXV, fig. 9.

Lernæa uncinata, *Müller*, Zool. Dan., i, t. 33, f. 2; Enc. méth., Vers, t. 78, f. 7 (copied from *Müller*).
— *Lamarck*, An. s. Vert., edit. 1st, iii, 231.
— *Johnston*, Loudon's Mag. Nat. Hist., viii, 565, f. 53.
— *Thompson*, Report on Fauna of Ireland, div. Invertebrata, in Report of Brit. Ass., 1843, 270.
— *Fabricius*, Faun. Grœnland., 338, No. 328.
— *Turton's* Gmelin, iv, 114.
— *Bosc*, Hist. Vers, i, 59, t. 1, f. 4.
Schisturus uncinatus, *Oken*, Lehrbuch der Naturg., b, iii, p. 183.
Clavella uncinata, *Oken*, l. c.
Lerneomyzon uncinata, *Blainville*, Dict. Sc. Nat., xxvi, 122.
Anchorella uncinata, *Nordmann*, Mikr. Beitr., ii, 102, t. 8, f. 8, 9, t. 10, f. 1-5.
— *Kroyer*, Tidsskrift, i, 290, t. 3, f. 8.
— *M. Edwards*, Hist. Nat. Crust., iii, 519.
Anchorella lagenula, Enc. Brit., edit. 7th, xxi, t. 502, f. 14.

Character.—Female. The body of the animal is thick, oblong, of a milk-white colour, smooth, and opaque. Head very small, situated at the extremity of a long, slender neck, which has a wrinkled appearance, and is nearly the length of the thorax. The arms spring from the upper portion of the thorax, and are rather short, terminating in a rounded knob or button. At the posterior portion of the thorax there is on the middle line a small protuberance, representing the abdomen. The ovarian tubes are cylindrical, straight, smooth, and about the length of the body. Length, from six to eight lines.

Male. Body globular, terminated in front by a small, conical eminence, at the extremity of which is the mouth, and having at its base one pair of rudimentary appendages, and a pair of rudimentary foot-jaws. On the middle of the body, on the inferior surface, there are two pairs of large, hooked, claw-like members. Length, one fourth of a line.

Hab.—Female. "It fixes itself to the fins and gill-covers of the cod and haddock, ... and is most probably the most common species of our seas." (Johnston.) Attached to the gills of the cod, Ireland, May 1837; to the gill-covers of a whiting, April 1837; W. Thompson, Esq. In the latter specimen the ovaries are considerably longer than the thorax.

2. ANCHORELLA RUGOSA. Tab. XXXV, fig. 8.

ANCHORELLA RUGOSA, *Kroyer,* Tidsskrift, i, 284, t. 2, f. 7.
— *M. Edwards,* Hist. Nat. Crust., iii, 519.

Character.—Body nearly of a square shape, a little emarginated on each side. Head small, neck slender, and nearly cylindrical. A rounded tubercle on middle line represents the abdomen. Ovaries rather larger than the thorax, nearly cylindrical, or slightly club-shaped. Length about three lines.

Hab.—From the mouth of a *Gadus cellarius,* taken at Larne; W. Thompson, Esq.

TRIBE III—*ANCHORACERACEA.*[*]

LERNÉOCÉRIENS (*pars*), *M. Edwards,* Hist. Nat. Crust., iii.

Character.—Females. Attached to their prey by the anterior extremity of their body only, thrusting the entire head into the tissues of the animal to which they adhere, and being retained there by means of a kind of horns, which are various in form, and spring from the posterior part of the head. No antennæ. Only one pair of foot-jaws, which is simple and hooked. Feet either very small or often wanting altogether.

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[*] Αγκυρα, anchor, and κερας, horn.

Males. Very small. Body globular, and more imperfect than in the preceding tribes, having no distinct thorax, and no rudiments of feet behind the appendages which represent the foot-jaws.

Family 1—PENELLADÆ.

LERNÉOCÉRIENS (*pars*), *M. Edwards*, Hist. Nat. Crust., iii.

Character.—Several pairs of feet situated on the under surface of the body near the head, but very small and rudimentary.

Genus LERNEONEMA.

LERNÆA, *Sowerby*, British Miscellany.
— *Blainville*, Turton's British Fauna.
LERNEOCERA, *Blainville*, Journ. Phys., xcv.
LERNEOPENNA, *Lesueur*, Journ. Acad. Philad., iii.
LERNEONEMA, *M. Edwards*, Hist. Nat. Crust., iii, 524.

Character.—Body long, slender, narrowed anteriorly in the form of a neck, which is terminated by a swollen head, furnished with two or three simple, curved, horn-shaped appendages. Abdominal portion of body of inconsiderable length, and simple. Oviferous tubes long and slender.

History.—The genus Lerneonema was established by M. Edwards, in his 'Hist. Nat. Crust.' (iii), to receive some species of Lerneadæ, resembling considerably the Pennatula of Linnæus (Penella, Oken), but which are destitute of the peculiar plumose abdomen which characterises distinctly this latter genus.

Baker seems to have known a species belonging to the genus, and describes it as British, in the 'Philosophical Transactions' for 1744. He calls it the "Eye-sucker," and says "it was found fixed by the snout to the eyes of a sprat." His figure is very bad, and no doubt difficult to be recognised. We must remember, however, that in removing the Lerneæ from the animals to which they are attached, the head is often torn away, and that the ovarian tubes, which in this genus are long and slender, may easily likewise be mutilated, and that one of these may be readily torn off. If we then examine a species of *Lerneonema spratta*, and compare it with the figure given by Baker, and read his description, we shall see at once that the animal described by him at p. 35 of vol. xliii, and represented at t. i, f. 2, 3, is clearly an individual of that species without the head, and with only one ovarian tube, which is represented as the body, "somewhat thicker than a hog's bristle," while the real body is represented as the head, the *neck* being the "snout."

In 1806, Mr. Sowerby again described this parasite of the sprat, in his 'British Miscellany,' and gives a figure of it, of the natural size *in situ*, attached to the eye of the little fish, and part of a magnified sketch, representing the head and neck, detached. These figures of Mr. Sowerby have apparently given rise to an amusing mistake on the part of M. de Blainville. How he saw the original figures of Sowerby it is difficult to say; perhaps in the possession of Dr. Leach. He has, however, in his paper in the 'Journal de Physique,' so often quoted above, reproduced the two figures, the one *in situ* of the natural size, the other the magnified sketch of the upper portion only, and described them as two distinct species! The only information, he adds, that he has concerning the two species is, "that they are copied from MS. drawings of the English voyage to the Congo!" The figure of the one *in situ* he names the *Lernæa cyclophora*, the eye of the sprat of Sowerby's figure being described as the round head of the Lernea! while the magnified figure he merely designates as a species of "*Lernéide articulée*," the outline of the unfinished short portion or commencement of the body of Sowerby's sketch being taken by him as the oviferous tubes!

One or two other species have since been described, but the number known is yet but few.

1. LERNEONEMA SPRATTA. Tab. XXXV, fig. 10.

LERNÆA SPRATTA, *Sowerby,* British Miscellany, t. 68, 1806.
LERNÆA CYCLOPHORA, *Blainville,* Journ. de Phys., xcv, t. 26, f. 7; 1822.
LERNÉIDE ARTICULÉE, *Blainville,* l. c., f. 17.
LERNEONEMA MONILLARIS, *M. Edwards,* Hist. Nat. Crust., iii, 525, t. 41, f. 5, 1840.
— *Thompson,* Report Brit. Assoc. for Advance. Sc. 1843, 270.
THE EYE-SUCKER, *Baker,* Phil. Trans., xliii, 35, t. 1, f. 2, 3, 1744.

Body slender, considerably larger at the posterior extremity. Head of tolerable size, rounded, and provided with two narrow, rather hooked horns at its back part, directed backwards. The head is connected to the body by means of a long and very slender cylindrical neck, which is furnished with about a dozen constrictions, which make this part of the body appear as if it were beset with an equal number of rings or knobs.

A short distance beneath the head it is very narrow, gradually increasing in size as it joins the body. Abdominal portion small, blunt, and obliquely truncate. The ovarian tubes are very long and slender, about as long again as the whole body of the animal.

Length of the body about an inch; ovaries, one inch and a half.

Hab.—Found attached to the eye of a sprat. London market, Nov. 1848; Mr. W. Wing.

2. LERNEONEMA ENCRASICOLI. Tab. XXXV, fig. 11.

LERNÆA ENCRASICOLI, *Turton,* British Fauna, i, 137, No. 108, 1807.

Body cylindrical, shorter than the preceding, and of about the same size at both extremities. The neck is long and slender, quite smooth, and destitute of the constrictions which mark so decidedly the preceding species. The neck is white, and the body is of a brown, horny colour.

The abdomen is like that of the preceding, and the ovarian tubes are long and slender, at least twice the length of the body. Turton describes the ovaries as "clear white." Perhaps they may be so in the living animal, but in the specimens preserved in spirits, they are of exactly the same colour as the body. In one specimen, however, one of the tubes is broken, and the ova have escaped, and in this the tube is white.

Length of the body about half an inch; ovaries, fully one inch.

Hab.—Attached to the body of a sprat, from Youghal; R. Ball, W. Thompson, Esq. "Found attached to the bodies of the *Clupea encrasicolus* and *sprattus* frequently, in Swansea Bay;" W. Turton, M.D. Attached to the body of a sprat; Mr. J. Doubleday. British Museum.

Family 2—LERNEOCERADÆ.

LERNÉOCÉRIENS (*pars*), *M. Edwards*, Hist. Nat. Crust.

Character.—No vestiges of feet on under surface of body, nor any appendages representing them.

Genus 1—LERNEOCERA.*

LERNÆA, *Linnæus, Barbut, Hermann, Lamarck.*
LERNEOCERA, *Blainville*, Journ. Phys., 1822.
— *Desmarest, Nordmann, Burmeister, Kroyer, Lesueur, M. Edwards.*

Character.—Body long and slender; head furnished with horn-shaped appendages, which are simple and symmetrical in form. Ovarian tubes straight, and of moderate length. Abdomen very small.

Linnæus was the first who noticed any of the animals belonging to this genus. In his 'Fauna Suecica,' 1746, he describes a species found in Sweden on the carp; a species which Barbut, in 1783, ascertained to be British. Hermann also, in 1783, describes and figures another species, and several have since that time been added to the list.

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* Λερναιος, belonging to Lernea, and κερας, horn.

Blainville, in his Monograph, so often quoted, formed the genus Lerneocera to receive several species which had then been described, and amongst others the species found by M. Surriray, of Havre, which led to the first notice of the young of the Lerneadæ.

The genus, as established by Blainville, contains two species, which have been separated from it by Kroyer and M. Edwards; but still it has been retained in a restricted sense by all succeeding authors.

LERNEOCERA CYPRINACEA. Tab. XXXV, fig. 13.

LERNÆA CYPRINACEA, *Linnæus*, Faun. Suec., No. 2100, t. 2, f. 2100; Syst. Nat., edit. 12th.
— *Barbut*, Gen. Vermium, t. 7, f. 3.
— *Turton*, Brit. Faun., 137, No. 105.
— *Lamarck*, An. s. Vert., iii, 230; Enc. méth., Vers, t. 78, f. 6.
LERNEOCERA CYPRINACEA, *Blainville*, Journ. de Phys., xcv, 377.
— *Desmarest*, Cons. gén. Crust., 346.
— *Burmeister*, Nov. Act. Nat. Cur., xvii, 309, t. 14 A, f. 1-3.
— *M. Edwards*, Hist. Nat. Crust., iii, 527.

Head furnished with four horn-shaped appendages, which are somewhat long and slender. The two outer or posterior are bifurcated; the anterior simple.

The thorax is very slender anteriorly, forming a long neck, but becomes much broader posteriorly, and when it terminates in the small abdomen, appears obliquely truncate. The oviferous tubes are cylindrical, and rather long. The length of the whole animal is about eight lines.

Hab.—" Found on the sides of the carp, bream, and roach, in many of our ponds and rivers, in great abundance." (Barbut.) I have not seen any specimens of this species.

Genus 2—LERNEA.

LERNÆA, *Linnæus, Müller, O. Fabricius, Oken, Cuvier, Lamarck, Burmeister, Kroyer, M. Edwards.*
LERNEOCERA, *Blainville, Nordmann.*

Character.—Body more or less twisted, and *outré* in appearance. Head furnished with horn-shaped appendages, which are irregularly branched. Ovarian tubes twisted into round masses, and placed under the posterior portion of the body. Abdomen of considerable size.

The genus Lernea is now restricted within very small limits. Established by Linnæus upon the *Lernea branchialis*, it is at the present day confined to that species and one or two others.

Blainville retained the genus Lernea, however, for some other species, some of which, as *Lernea cyclophora* (vide supra, p. 340), are inadmissible altogether, and others, as *Lernea Basteri*, founded upon a figure given by Baster, are very doubtful. The name Lernea was retained by him, he says, "for those species which have no trace of appendages to either the head or the body; those, in fact, which are most deformed." Burmeister, Kroyer, and M. Edwards, however, agree in referring the genus to the species first described by Linnæus as the type, and have assigned to it its characters accordingly.

LERNEA BRANCHIALIS. Tab. XXXV, fig. 12.

LERNÆA BRANCHIALIS, *Linnæus*, Syst. Nat., edit. 12th.
— *Lamarck*, An. s. Vert, iii, 240.
— *Cuvier*, Règne An., iii, 256.
— *Burmeister*, Nov. Act., xvii.
— *Guerin*, Icon. Règne An. Zooph., t. 9, f. 1; Encyc. Britann., edit. 7th, xxi, t. 502, f. 13.

Lernea branchialis, *Kroyer,* Tidsskrift, i, t. 3, f. 10 (?).
— *Oken,* Lehrbuch der Naturg., t. 7.
— *M. Edwards,* Hist. Nat. Crust., iii, 528.
— *Thompson,* Report Brit. Assoc. for Advanc. Sc, 1843, 270.
Lernæa gadina, *Müller,* Zool. Dan., iv, 65, t. 118, f. 4.
— *O. Fabricius,* Faun. Grœnl., 339.
Lerneocera branchialis, *Blainville,* Journ. de Phys., xcv, 376, tab. 26, f. 1, 1 *a*.
— *Nordmann,* Mikr. Beitr., ii, 130.
Lernæa, *Ström,* Phys. og Oecon. Besk., t. 1, f. 18.

Head rounded, and furnished with three horn-shaped appendages, each of which is divided at the tip into three short branches.

The anterior portion of the thorax is long, cylindrical, and very slender, like a long narrow neck, while the body itself is very much swollen in the middle, and abruptly twisted upon itself in the form of the letter S.

The abdominal portion of the body is long, blunt at extremity, and of considerable size. The ovarian tubes are slender, and very much twisted.

The whole animal is about an inch and a half in length, and is of a very firm consistence, being hard and horny.

Hab.—Gills of the cod. Belfast Bay, January 1844 and 1848; W. Thompson, Esq. Dublin; communicated to Mr. Thompson by Mr. Glennon, in 1839.

APPENDIX.

A.

CYCLOPS QUADRICORNIS.

The varieties of this protean species are many, and are well worthy of being carefully studied. Since the description of this species and its varieties was in the hands of the printer, I have been favoured with a letter from Dr. Beverley R. Morris, of York, containing sketches of the caudal segments of four different varieties obtained by him in the neighbourhood of that city. In one, the two long middle setæ of the tail are plumose to the extent of a little more than half their length, while the external short ones are not plumose at all. In a second variety, the two middle setæ are plumose for more than two thirds of their length, while the external are plumose throughout their whole extent. In a third variety, the two middle setæ are plumose throughout nearly their whole length, and the external entirely so. While in a fourth, none of the setæ appear plumose in any portion of their extent. "These setæ," writes Dr. Morris, "I have been very careful to feather accurately. . . . I have been very careful," he adds, "to measure as accurately as I could, the length, &c. of the different parts, and I think they may be depended upon. They were also all verified by a friend of mine who is with me examining the water of this district." Mr. Halliday also informs me that a variety occurs frequently in Ireland in which the tail setæ are not plumose.

B.

CAMPTOCERCUS FURCATUS.

The figures of this species, represented in Tab. XXX, figs. 4, 5, 6, made by Mr. Salter, were accompanied by some very interesting notes, from which, with Professor Bell's kind permission, I make the following extracts: "It is scarcely more than visible to the naked eye. Its head and shoulders are covered with a single case, which seems a sort of carapace; below this are three imbricated rings with concave edges, looking towards the tail, their angles projecting and forming sort of teeth. To the last of these is appended the tail, composed of six pieces, flexible, capable of lateral and, I think, vertical movement. In the centre of the front of the head is a reddish-purple spot, which shines very much in some lights, and looks like a single eye. The most remarkable thing about this little creature is its extraordinary power of movement, which is well provided for by three pairs of strong oar-like legs, which it casts behind it with great force, throwing itself forward with surprising velocity, and outstripping even the little sand-hoppers that hunt it. These legs, when in a state of rest, are bent up under it, and when it means to throw itself forward, it bends backward that part of its leg which pointed forward, keeping the other part in the same direction; thus 'a' is brought to 'b', 'c' to 'd,' and 'e' to 'f,'* the oblique direction of the other part being, as I said, still maintained. As these legs are webbed with hairs, the three present a broad surface against the water. When the extension is completed, I have no doubt that the muscular action which kept the fixed direction of this last joint is relaxed, and it is drawn up in such a way as shall present the least resistance to the water. There are also two little processes like rudimentary legs, rising from beneath the first joint of the tail." At this time Mr. Salter had not seen a specimen with ova. Shortly afterwards, however, he had an opportunity of examining a female loaded with eggs, upon which he remarks: "Another use, perhaps the especial use, of these two little appendages at the base of the tail seems to be shown; their position exactly fits them to become a means of supporting and keeping in its place the cluster of eggs. Now with regard to the eggs themselves, the great size of the cluster, and the unyielding nature of the integuments of the animal, seem to be the causes of their external position. I think the cluster consists of two layers, the one continuous, the other with an intermission down the middle, forming a sort of fossa for the tail. You will see from the figure (f. 4 *a*) that it has a more semi-transparent line down the middle, corresponding in size with the tail, and in the same position. Doubling then the number of a single layer, and subtracting for the intermission (40+40—10), the number of ova would be about 70. Its abdomen, for such its tail clearly is, is evidently simple, and merely bifurcated at the end. It has a canal, the contents of which had a very singular and regular up-and-down movement, synchronous with what appeared to be a circulatory or respiratory movement of the viscera near the head."

---

* This refers to a slight sketch of these organs in position, made by Mr. Salter on the margin of the letter.

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EXPLANATION OF PLATES.

Tab. I.

Fig. 1. *Apus cancriformis.*

a. Mandible. *b.* Mouth. *c.* Antenna. *d.* First pair of feet. *e.* Second do. *f.* Eleventh do. *g.* Twelfth do. *h.* Branchial plate.

2. Young animal. 3. Do. a little older.

Tab. II.

Fig. 1. *Nebalia bipes.*

a. First pair of jaws. *b.* One of the branchial feet. *c.* One of the natatory feet.

2, 3. *Artemia salina,* male and female.

Fig. 2, *a.* Antenna of male. *b.* Antennule. *c.* One of the branchial feet.

4. Do. young.

Tab. III.

Figs. 1, 2. *Chirocephalus diaphanus,* male and female.

Tab. IV.

Chirocephalus diaphanus.

Fig. A. Antennule. B. Prehensile antennæ of male. C. Appendages belonging to them. C*. Profile view of ditto. D. Triangular plate of ditto. E. Head of female in profile, with antennæ. F. Dorsal view of ditto, to show the eyes. G. Labrum. H. Mandible.

In Figs. B, C, C*, E, and F—*a,* represents the antennules; *b,* large antennæ; *c,* trunk; *d,* flexible appendages; *e,* triangular plate; *f,* organ similar to what is seen in Evadne; *g,* eyes; *h,* remains of fœtal eye; *i,* organ similar to what Zaddach calls in Apus the glandular processes of stomach; *k,* mandible; *m,* labrum.

Tab. V.

Chirocephalus diaphanus.

Fig. A. Jaws. * One of the setæ magnified. B. One of the branchial feet. C. Male organ of generation.

Fig. 1. Ovum.
2. Young, half detached from ovum.
3. Young, while still in internal envelope.
4. Do. two hours old.
5. Do. a little further advanced.
6. Do. in a more advanced stage of development.
7. Do. still further advanced.

Tab. VI.

Figs. 1, 2, 3. *Daphnia pulex;* male and female, and variety.

Tab. VII.

Fig. 1. *Daphnia Schœfferi*, female.
2. Do. young.
3. *Daphnia pulex;* variety *longispina.*
4. Do. young.
5. *Daphnia reticulata*, female.

Tab. VIII.

Daphnia Schœfferi, details.

Fig. A. Head, principally to show the muscular system. *a, n.* Basal joint of large antenna, with its elevator and depressor muscles. *b.* Antennules. *c.* Eye, with its rotatory muscles, optic nerve, and brain. *e, k.* Muscles attaching the body of the animal to the carapace. *f.* Mandible, with its muscles. *g.* Muscle of the labrum. *p.* Jaws.

Fig. B. Head, principally to show the organs of digestion. *b, c, f, p,* represent the same organs as in fig. A. *d.* Cæcum. *e.* Stomach. *g.* Labrum. *i.* Heart.

Fig. C. Labrum, with *a, b, c,* its elevator and depressor muscles. D. Mandible. E. One of the first pair of legs. F. Second do. G. Third do. H. Fourth do. I. Fifth do. P. Jaws.

Tab. IX.

Fig. 1. *Moina brachiata.*
2. Do. young.
3. *Daphnia psittacea.*
Fig. 4. *D. psittacea*, young.
5. *D. pulex*, young.
6. *D. rotunda*, young.

Tab. X.

Fig. 1. *Daphnia vetula.*
a. Head magnified to show antennules.
2. *D. mucronata;* var. *obtuse rostrata.*
3. *D. mucronata;* var. *acute rostrata.*
4. *D. rotunda.*
a. Head magnified to show antennules.

TAB. XI.

Figs. 1, 2. *Moina rectirostris*, male and female.
1 *a*. Antennule of male
3. *Daphnia pulex;* var. *magna*, female.
4, 5. Male of do.

Fig. 4 represents the male in a very young state, previous to its final moulting, and before it assumes its perfect form.
5 *a*. Antennule of male.

TAB. XII.

Fig. 1. *Daphnia reticulata*, male.
a. Antennule. *b*. One of the first pair of feet.
2. *D. reticulata ;* var. *quadrangula.*
3. *Sida crystallina*, female.

Fig. A. Head magnified, in profile. *b*. Antennule *c*. Eye. *e*. Stomach. *f*. Mandible. *g*. Labrum. *q*. Organs by which the animal attaches itself to objects. *r*. Heart.
Fig. B. Eye magnified, to show the disposition of the crystallines or facets.

4. *Sida crystallina*, young.

TAB. XIII.

Fig. 1. *Sida crystallina.*

a. Antennule. *b*. Large antenna or ramus. *c*. Mandible. *d*. One of the first pair of feet. *e*, *f*. Fourth pair of feet. *g*. Sixth pair of feet. *h*. Abdomen.

TAB. XIV.

Fig. 1. *Daphnella Wingii*, female.
3. Do. supine.
4. Head of do. highly magnified.

a. Stomach. *b*. Antennule. *c*. Eye. *f*. Mandible. *g*. Labrum. *i*. Heart. *o*. Œsophagus.

2. *D. Wingii*, male.
a. Antennule. *b*. Abdomen.

TAB. XV.

Fig. 1. *Eurycercus lamellatus.*

a. Superior antenna. *b.* Inferior do. *c.* Mandible. *d.* Labrum. *d**. Jaws. *e.* First pair of feet. *f.* Second do. *g.* Third do. *h.* Fourth do. *i.* Fifth do. *k.* Abdomen. *l.* Eye.

2. *Macrothrix laticornis,* female.

a. Inferior antenna.

3. *Bosmina longirostris.*

a. Inferior antenna.

TAB. XVI.

Fig. 1. *Peracantha truncata.*

a. Inferior antenna. *b.* Intestine.

2. *Alona ovata.* Fig. 3. *Alona reticulata.*
4. *Alona quadrangularis.*

a. Labrum. *b.* Abdomen.

5. *Acroperus harpa.* Fig. 6. *Acroperus nanus.*
7. *Chydorus globosus.*

a. Jaws. *b.* Inferior antenna. *c.* Abdomen.

8. *Chydorus sphæricus.*
9. *Camptocercus macrourus.*

a. Abdomen.

TAB. XVII.

Fig. 1. *Polyphemus pediculus.*

a. Inferior antenna. *b.* One of the first pair of legs.

2. *Evadne Nordmanni.*

a. View of the legs (from Loven).

3. *Pleuroxus trigonellus.*

a. Antennule. *b.* First pair of feet. *c.* Abdomen.

4. *P. uncinatus.* Fig. 5. *P. hamatus.*

Fig. A. Convoluted intestine of *Eurycercus lamellatus.*
Fig. B. Do. of *Chydorus globosus.*
a. Œsophagus. *b, c, d.* Convolutions. *f.* Anus.

Tab. XVIII.

Fig. 1. *Cypris tristriata.*

a. Body of the animal, with the shell removed. *b.* Superior antenna. *c.* Inferior do. *d.* Mandible. *e.* First pair of jaws. *e**. Branchial plate of do. *f.* Second pair of jaws. *g.* First pair of feet. *h.* Second pair of do. *i.* Abdomen.

2. Ovum.
3. Young.
4. *Cypris clavata.*

Fig. 5. *C. Joanna.*
6. *C. monacha.*
7, 8. *C. minuta.*

Tab. XIX.

Fig. 1. *Candona lucens.*
2. *C. similis.*
a. Inferior antenna.
3. *C. reptans.*
a. Inferior antenna.
4. *C. hispida.*
5. *Cypris sella.*
a. Inferior antenna.
6. *C. elongata.*

Fig. 7. *C. fusca.*
8. *C. gibbosa.*
9. *C. Westwoodii.*
10, 11. *C. vidua.*
12. *C. elliptica.*
13. *C. aurantia.*
14. *C. compressa.*
a. Superior antenna. *b.* Inferior do. *c.* Mandible.

Tab. XX.

Fig. 1. *Cythereis Jonesii.*
2. *C. antiquata.*

Fig. 3, 3 *a.* *C. Whiteii.*
4. *Cythere Minna.*

4 *a.* Mandible and palpus. *b.* Superior antenna. *c.* Inferior do. *d.* First pair of legs.

5. *Cythere reniformis.*

a. Body of animal, with the shell removed. *b.* Superior antenna. *c.* Mandible and palpus. *d.* First pair of jaws, with the branchial plate attached. *e.* Inferior antenna. *f.* Last pair of feet.

6. *Cythere alba.*

Fig. 7. *C. albo-maculata.*

Tab. XXI.

Fig. 1. *Cythere inopinata.*

a. Ventral view. *b.* Superior antenna. *c.* Inferior do. *d.* First pair of legs. *e.* Last pair of do.

2. *C. quadridentata.*
3. *C. convexa.*
4, 4 *a.* *C. nigrescens.*
5, 5 *a.* *C. acuta.*
6, 6 *a.* *C. angustata.*
7. *C. pellucida.*

Fig. 8. *C. aurantia.*
9. *C. impressa.*
10, 10 *a*, 11. *C. variabilis.*
12, 12 *a.* *C. flavida.*

Tab. XXII.

Fig. 1. *Cypridina Mac Andrei.*

a. Animal, with the shell removed. *b.* Natatory feet. *c.* Second pair of antennæ. *d, d.* Second pair of jaws. *e.* First pair of antennæ. *f.* Oviferous foot. *g.* Abdomen.

Tab. XXIII.

Fig. 1. *Cypridina Brenda.*

a. Eye. *b.* Natatory foot. *c, c.* Second pair of antennæ. *d.* Second pair of jaws. *e.* First pair of antennæ. *f.* Oviferous foot. *g.* Branchial plate of first pair of jaws.

Tab. XXIV.

Cyclops quadricornis.

Fig. 1. Male.
2. Female.
3. Var. *a*, *elongatus.*
4. Var. *b.*
5. Var. *c.*

Fig. 6. Ovum.
7. Young, just born.
8. Do. 8 days old.
9. Do. 15 days old.
10. Do. 17 days old.

a. Antennule. *b.* Mandible. *c.* First pair of foot-jaws. *d, e.* Second pair of foot-jaws. (*d.* Internal division. *e.* External do.) *f.* First pair of thoracic feet. *g.* Fifth pair of feet; fulcra, or "supports."

Tab. XXV.

Figs. 1, 2. *Canthocamptus furcatus*, prone and in profile.

2 *a*, First pair of thoracic feet.

3. *C. minuticornis.*

4, 5. *C. minutus*, male and female.

4 *a*. Antenna of male. 5 *a*. Do. of female. *b*. Antennule. *c*. Mandible. *d*. Second pair of foot-jaws. *e*. First pair of do. *f*. First pair of thoracic feet. *g*. Second pair of do. *h*. Third pair of do. *i*. Fifth pair of feet.

Tab. XXVI.

Figs. 1, 2. *Diaptomus castor*, male and female.

2 *a*. Antennule. *b*. Mandible. *c*, *d*. First pair of foot-jaws. (*d*. Profile view.) *e*. Second pair of foot-jaws. *f*. Third pair of do. *g*. First pair of thoracic feet. *h*. Second pair of do. *i*. Fifth pair of feet, in the male. *j*. Do., in the female.

Tab. XXVII.

Figs. 1, 2. *Anomalocera Patersonii*, male and female.

1 *a*. Antennule. *b*. Mandible and palpus. *c*. First pair of foot-jaws. *d*. Second pair of foot-jaws. *e*. Third pair of do. *f*, *g*. The head in two different positions, to show the sharp-pointed beak, and the situation of the eye. *h*. First pair of thoracic feet. *i*. Fifth pair of feet in the male.

2 *a*, *b*. Head of female; two different views to show the beak, the eye, and the sharp, curved spine on first ring of thorax. *c*. Fifth pair of feet in the female.

3. *Canthocamptus Stromii.*

a. First pair of thoracic feet.

Tab. XXVIII.

Fig. 1. *Temora Finmarchica.*

a. Mandible and palpiform branch. *b*. Antennule. *c*. First pair of foot-jaws. *d*. Second do. *e*. Third do. *f*. Antenna. *g*. First pair of thoracic feet.

2. *Arpacticus nobilis.*

a. Antenna. *b*. Antennule. *c*. Fifth pair of feet. *d*. Posterior foot-jaws. *e*. First pair of thoracic feet.

TAB. XXIX.

Fig. 1. *Cetochilus septentrionalis.*

a. Styliform appendages in front of cephalo-thoracic segment, which take the place of the sharp-pointed beak of Anomalocera. *b.* Mandible and palpus. *c.* Antennule. *d.* First pair of foot-jaws. *e.* Second do. *f.* Third do. *g.* First pair of thoracic feet.

2, 3. *Arpacticus chelifer,* male and female.

3 *a.* Antenna. *b.* Antennule. *c.* Mandible. *d.* Fifth pair of feet. *e.* Posterior foot-jaws. *f.* First pair of thoracic feet. *g.* Second pair do.

TAB. XXX.

Figs. 1, 2. *Alteutha depressa,* male and female.

a. First pair of thoracic feet. *b.* Abdominal appendage.

3. *Canthocamptus minutus,* to show the club-shaped organ attached to the abdomen.

4, 5, 6. *Canthocamptus furcatus.*

4 *a.* Ovary.

5 *a.* Antennule. *b.* Last pair of feet.

These figures are copied from drawings made by Mr. Salter.

7, 8. *Notodelphys ascidicola.*

7 *a.* Antennule (?). *b.* Mandible. *c.* First pair of foot-jaws. *d.* Second do. *e.* Third do. *f.* Fourth do. *g.* One of the natatory feet.

TAB. XXXI.

Fig. 1. *Argulus foliaceus.*

2. View of part of the carapace, to show the ramification of opaque tubes or intestines.

a. Antenna. *b.* First pair of foot-jaws. *d.* Sheath containing the siphonal tube. *c.* Extremity of siphon, with its sharp-pointed style. *e, f.* Second pair of foot-jaws, or *suckers.* *g.* Third pair of foot-jaws, or prehensile feet. *h, i.* First pair of natatory legs. *k, l.* Fourth pair of do.

Tab. XXXII.

Fig. 1. *Caligus diaphanus.*
2, 3. *C. rapax*, male and female.
4, 5. *C. Mulleri*, male and female.
6, 7. *C. centrodonti*, male and female.
8, 9. *Lepeoptheirus Stromii*, male and female.
10. *L. pectoralis*, female.
11. *L. obscurus.**
12. *L. hippoglossi*, female.

Tab. XXXIII.

Fig. 1. *Lepeoptheirus Nordmannii.*
2. *L. Thompsoni.*
3, 4. *Trebius caudatus*, male and female.
5. *Chalimus scombri.*
a. View of do., adhering to *Caligus Mulleri.* *b.* Rostrum.
6, 7. *Dinemoura alata*, male and female.
8. *D. lamnæ*, female.
9. *Anthosoma Smithii.*
10. *Pandarus bicolor*, female.
11. *Nicothoe astaci.*

Tab. XXXIV.

Figs. 1, 2. *Cecrops Latreilleii*, male and female.
3, 4. *Læmargus muricatus.*
5. Carapace of *Caligus diaphanus;* under surface, to show the different organs *in situ.*

a. Lunules or sucking-discs. *b.* Antenna. *c.* First pair of foot-jaws. *f.* Mouth. *g.* Organs representing the posterior pair of jaws. *h.* Second pair of foot-jaws. *i.* Third pair of do. *j.* Sternal fork. *k.* First pair of thoracic feet. *l.* Second pair of do. *m.* Third pair of feet. *n.* Fourth pair of do.

Fig. A. First pair of foot-jaws of *Lepeoptheirus Nordmannii.* B. Mouth and posterior jaws of do. C. Sternal fork of do. D. Sternal fork of *L. hippoglossi.* E. Fourth pair of feet of *Trebius caudatus.*

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* This may possibly prove to be the male of *L. hippoglossi.*

TAB. XXXV.

Fig. 1. *Chondracanthus Zei.*
2. *Lernentoma cornuta.*
3. *L. Lophii.*
4. *L. asellina.*
5. *Lerneopoda elongata.*
6. *L. salmonea.*
7. *L. galei.*
8. *Anchorella rugosa.*
9. *A. uncinata.*
10. *Lerneonema spratta.*
11. *L. encrasicoli.*
12. *Lernea branchialis.*
13. *Lerneocera cyprinacea.*

TAB. XXXVI.

Figs. 1, 2, 3. Ovum and young, in different stages, of a Caligus.

Taken from figures by H. Goodsir in 'Edinb. New Philosophical Journal,' vol. xxxiii, tab. 3.

4, 5. Profile and under-side view of the male of *Anchorella uncinata.*

6, 7. Male of *Lernentoma cornuta,* profile and under-side.

These two species are taken from figures by Nordmann, 'Mikr. Beitr.' tab. ix and x.

8. Young of a species closely allied to *Lerneocera cyprinacea.*

From Nordmann, l. c. tab. vi.

9. Male of *Lerneopoda elongata.*

Taken from Kroyer's 'Tidsskrift,' vol. i, tab. iii.

10. Male of *Lernentoma Lophii.*

From Kroyer, l. c.

11. Male of *Lerneopoda galei.*

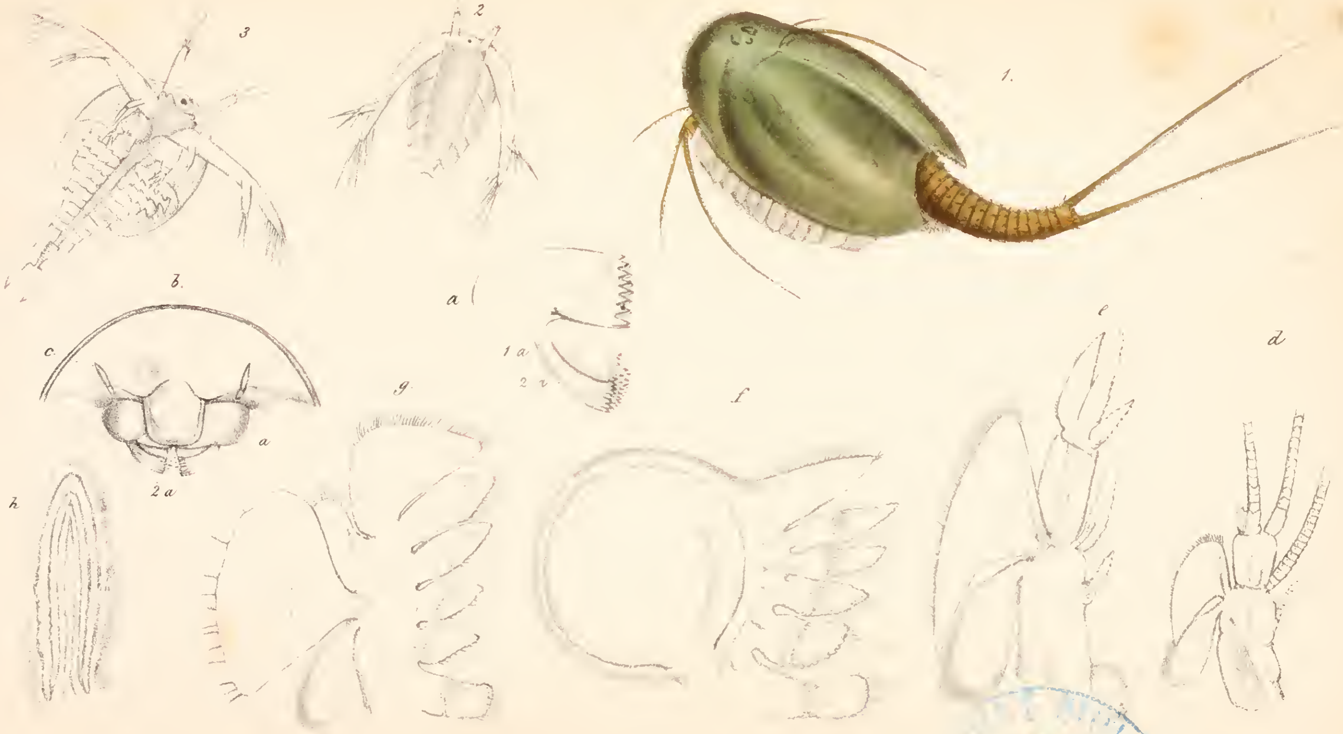
From Kroyer, l. c.

Fig. A. Under surface of head of *Anchorella uncinata,* magnified. *a, b.* Organs of mouth. *c.* Styliform appendage to do. *d.* Antenna. *e, f, g, h.* Foot-jaws.

From Nordmann, l. c. tab. viii.

C AND J. ADLARD, PRINTERS, BARTHOLOMEW CLOSE.

Tab 1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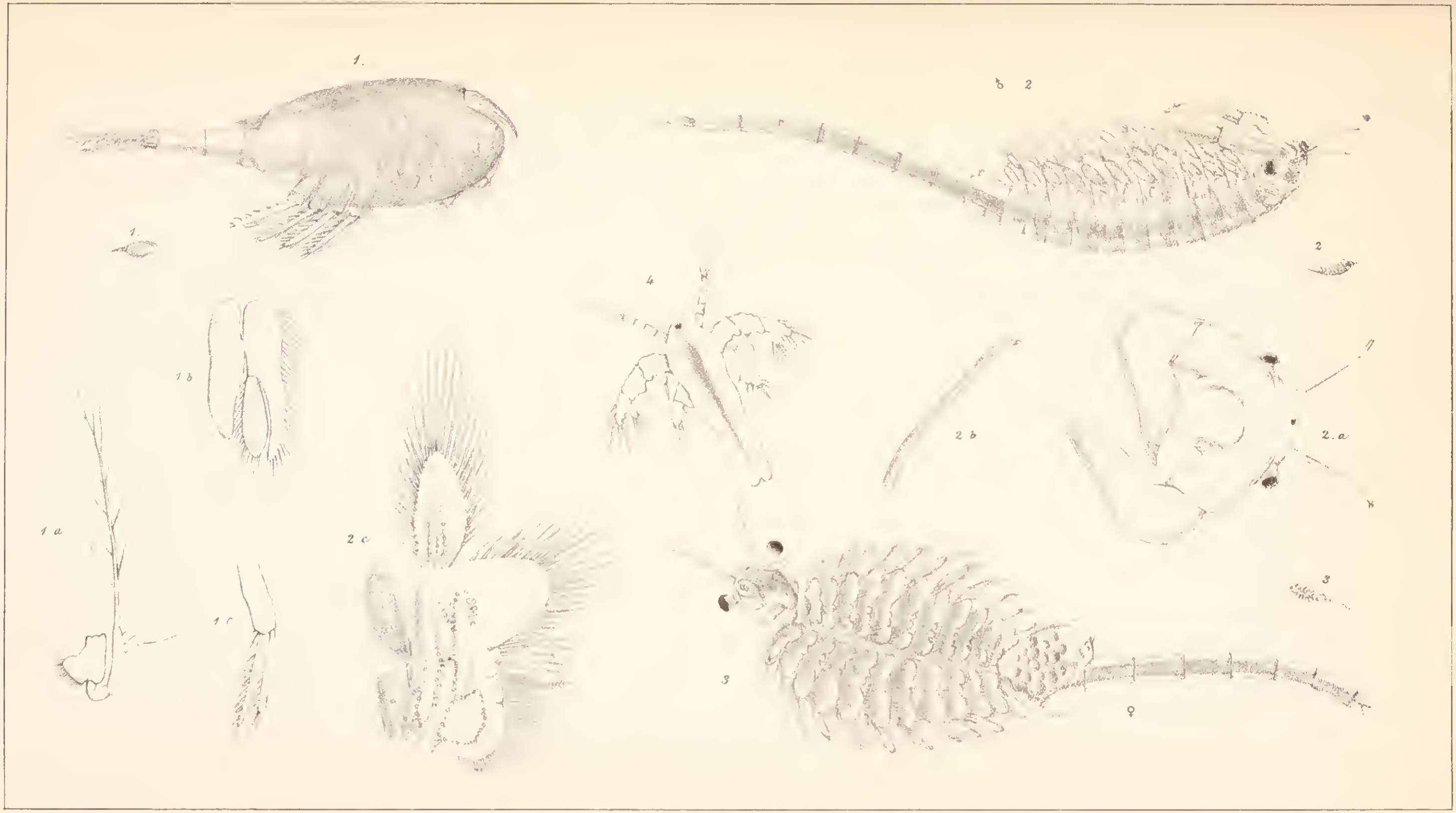
W. Wing, ad nat lith

Reeve Benham & Reeve imp.

APUS CANCRIFORMIS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W. Wing, ad nat lith.

Reeve Benham & Reeve imp

1. NEBALIA BIPES 2 3 ARTEMIA SALINA ♂ & ♀
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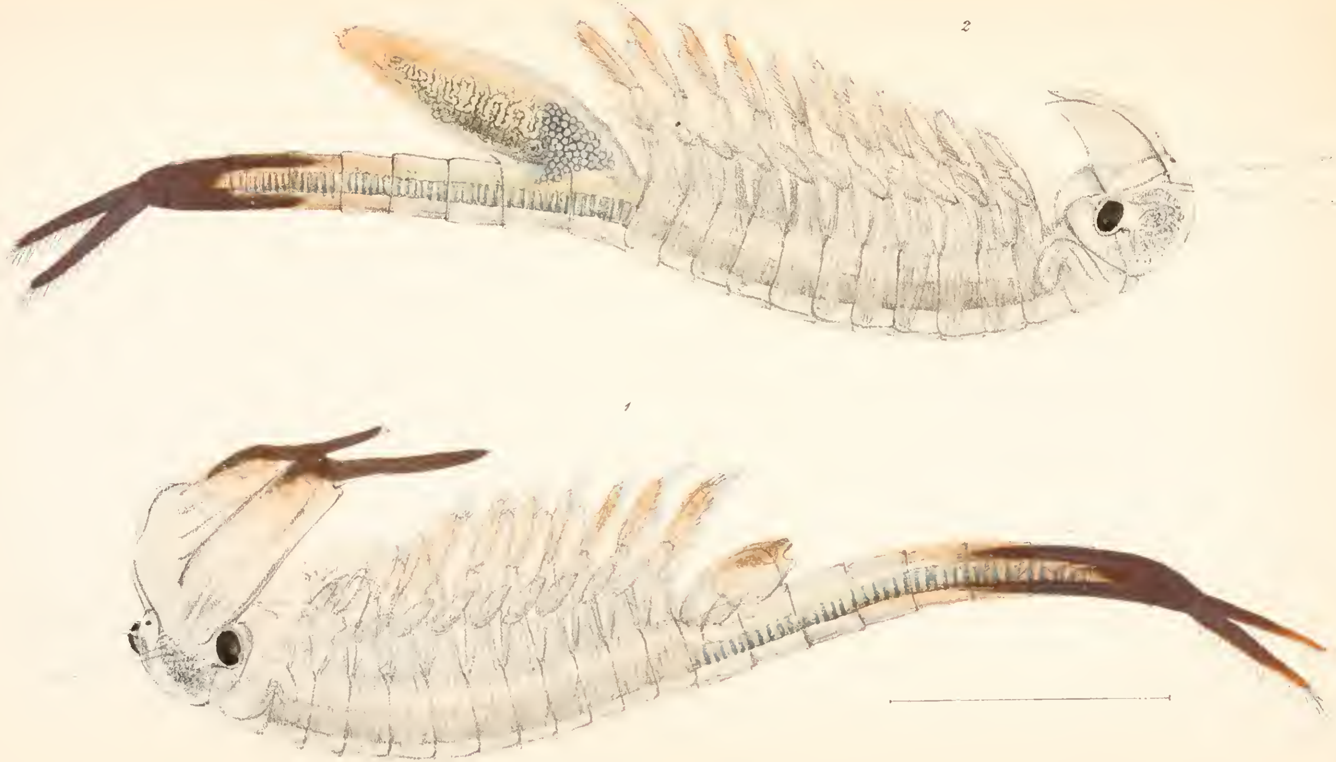
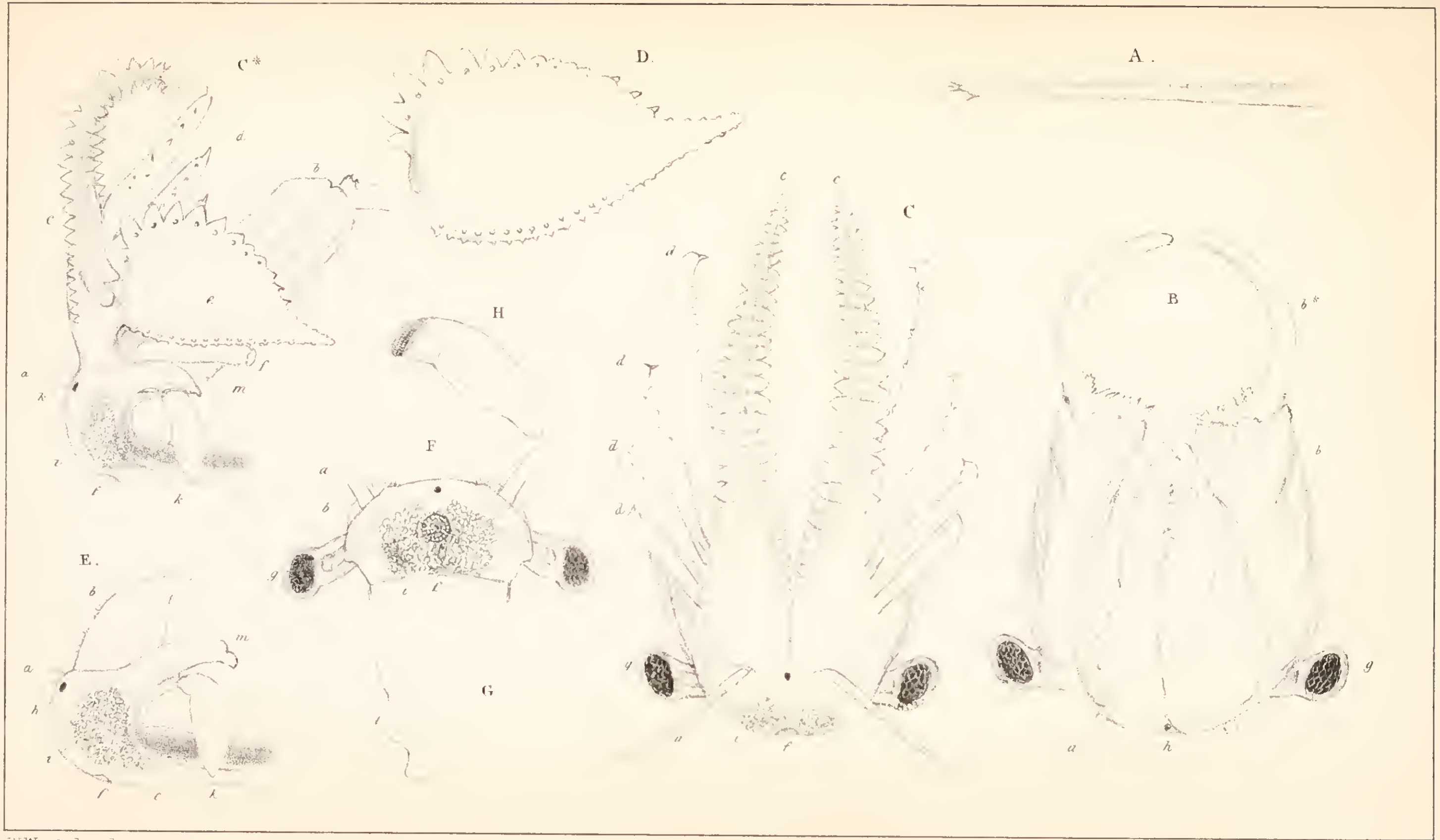
Tab.III



W. Wing ad nat lith.

Reeve Benham & Reeve imp.

CHIROCEPHALUS DIAPHANUS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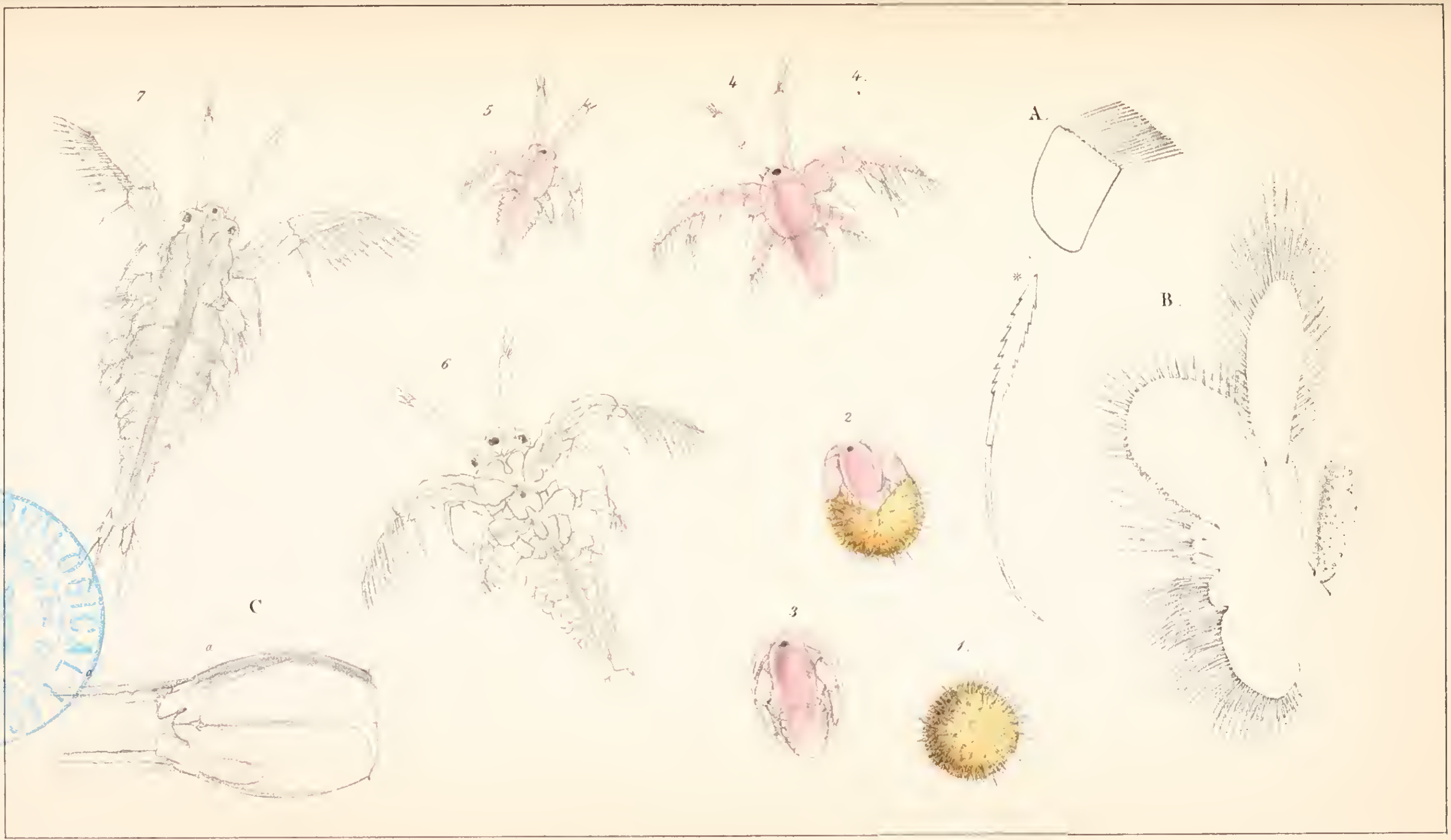
W.Wing ad nat lith.

Reeve Benham & Reeve imp.

CHIROCEPHALUS DIAPHANUS

Tab. V.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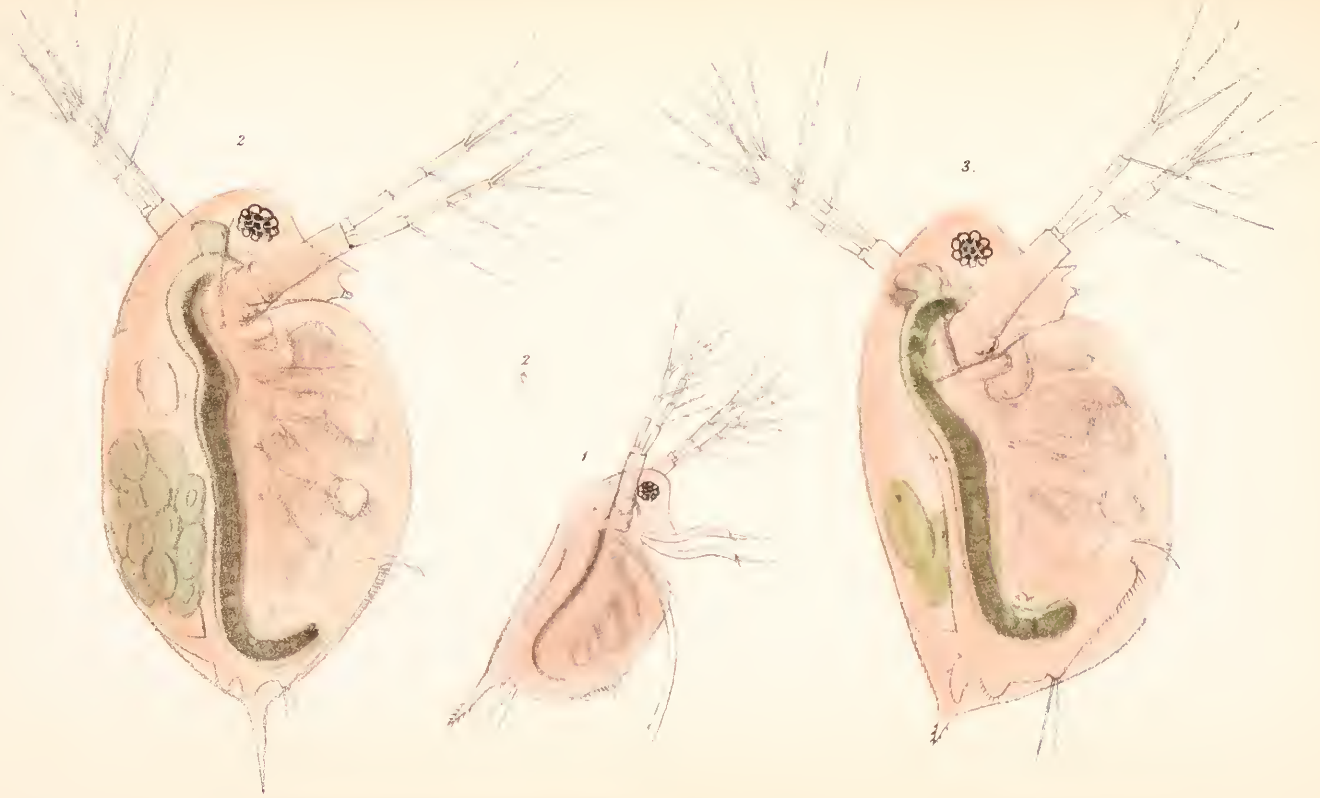
W Wing ad nat lith

Reeve Benham & Reeve imp

CHIROCEPHALUS DIAPHANUS

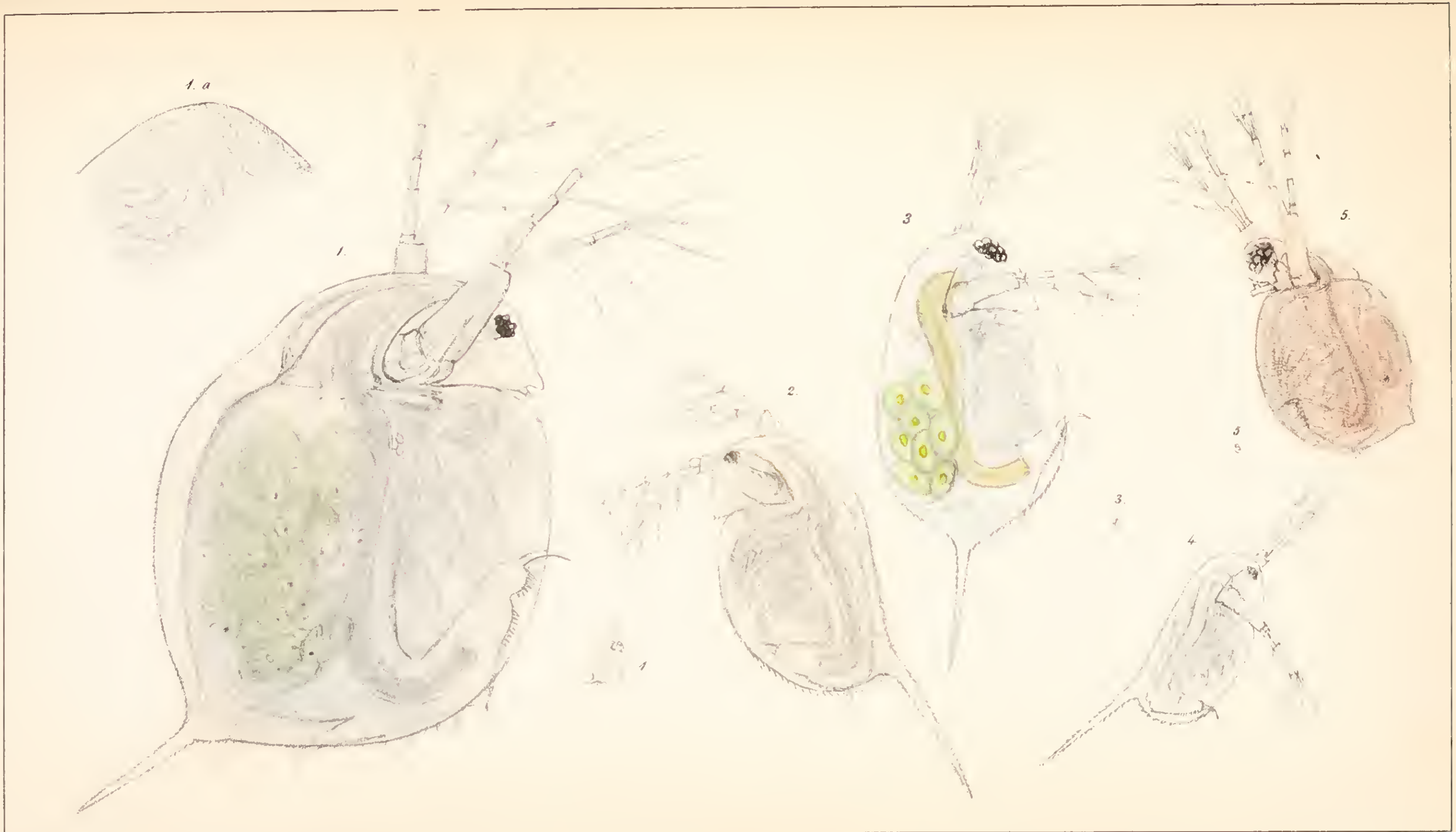


D^r Baird del. W. Wing lith.

Reeve Benham & Reeve imp.

DAPHNIA PULEX.

Tab VII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W Wing ad nat lith

Reeve Benham & Reeve imp

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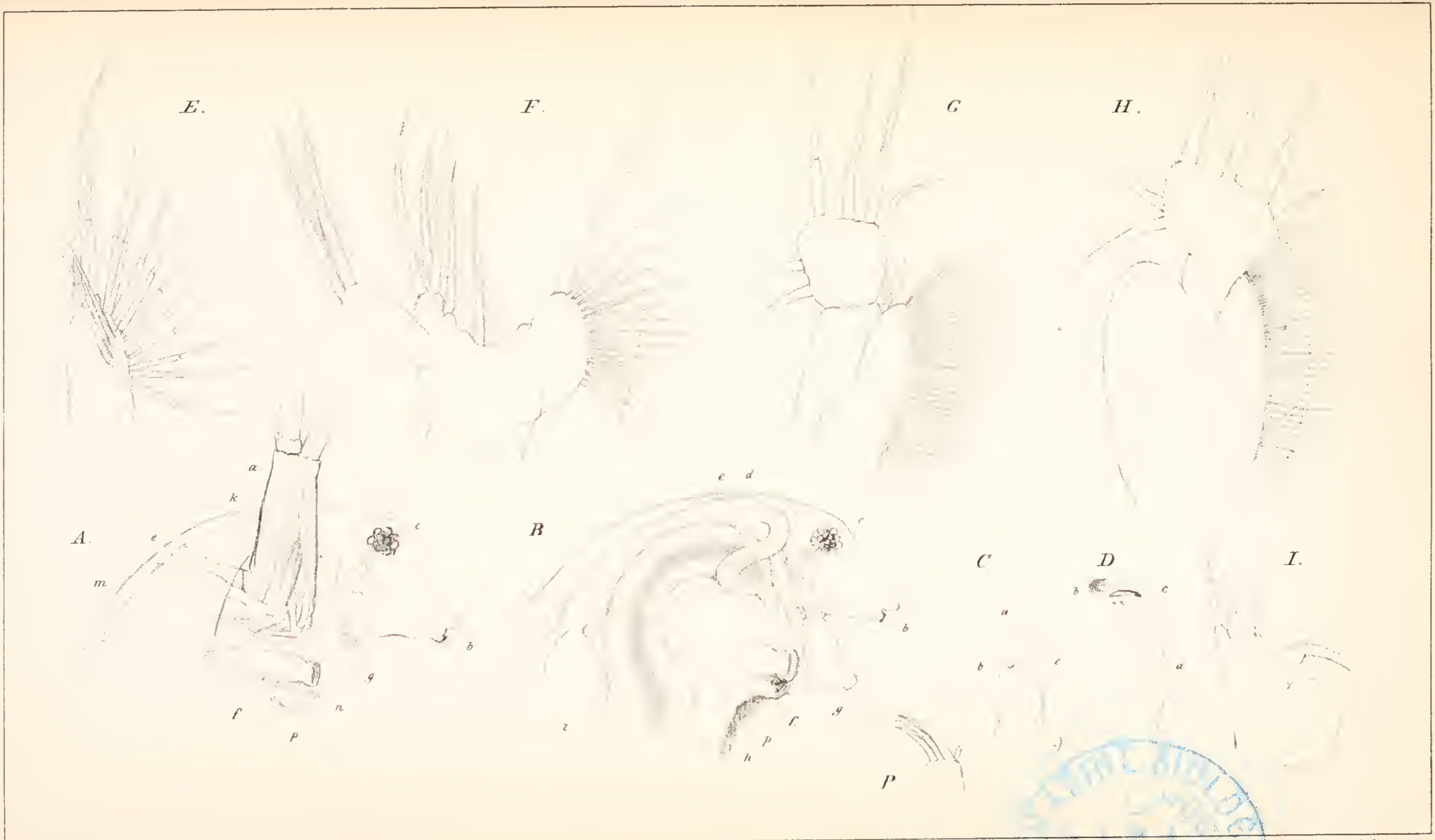
2. .... JUN^{R} 4 ...... JUN^{R}
5. D RETICULATA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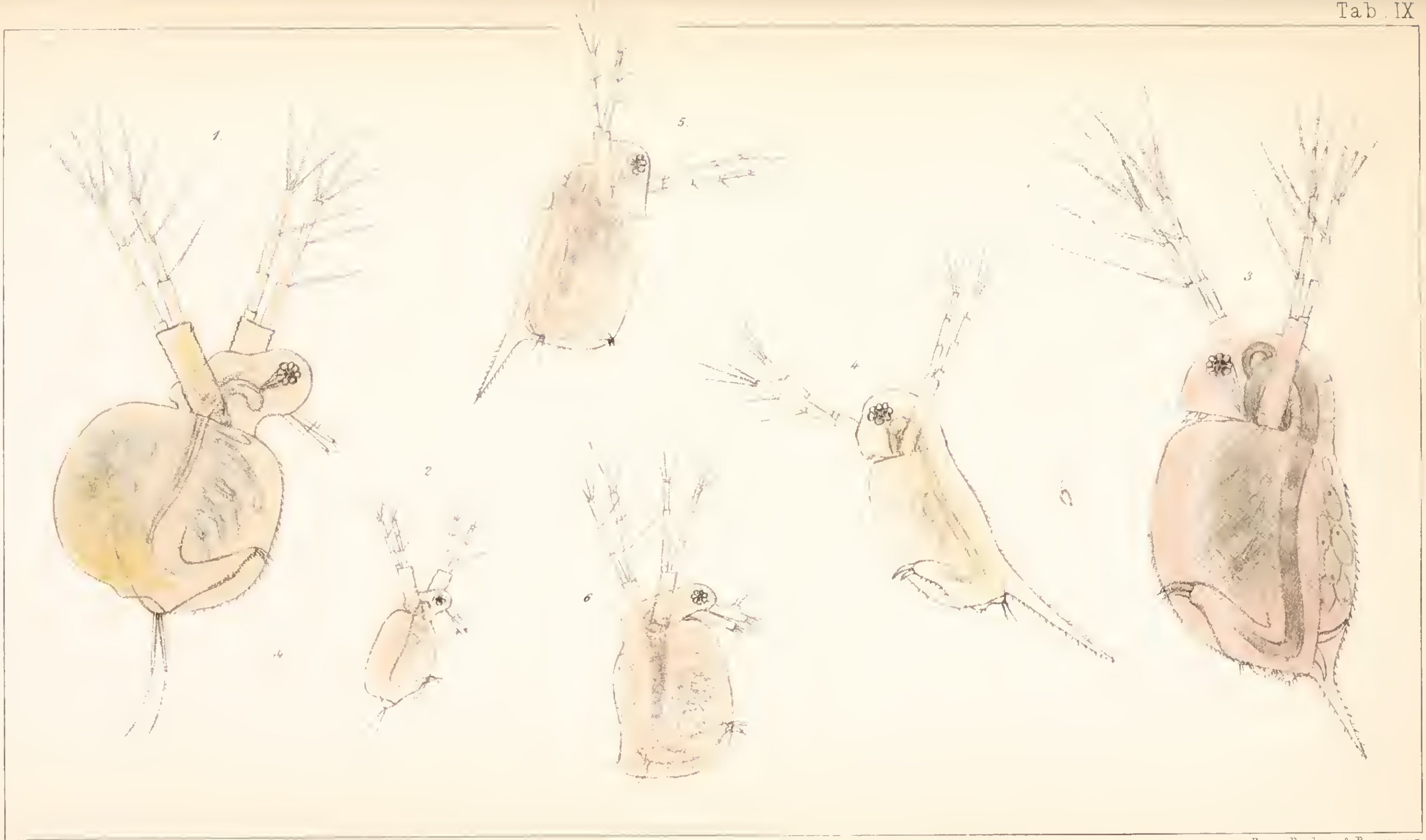
T. Wing ad nat lith.

Reeve Benham & Reeve imp.

DAPHNIA SCHÆFFERI.

Tab. IX

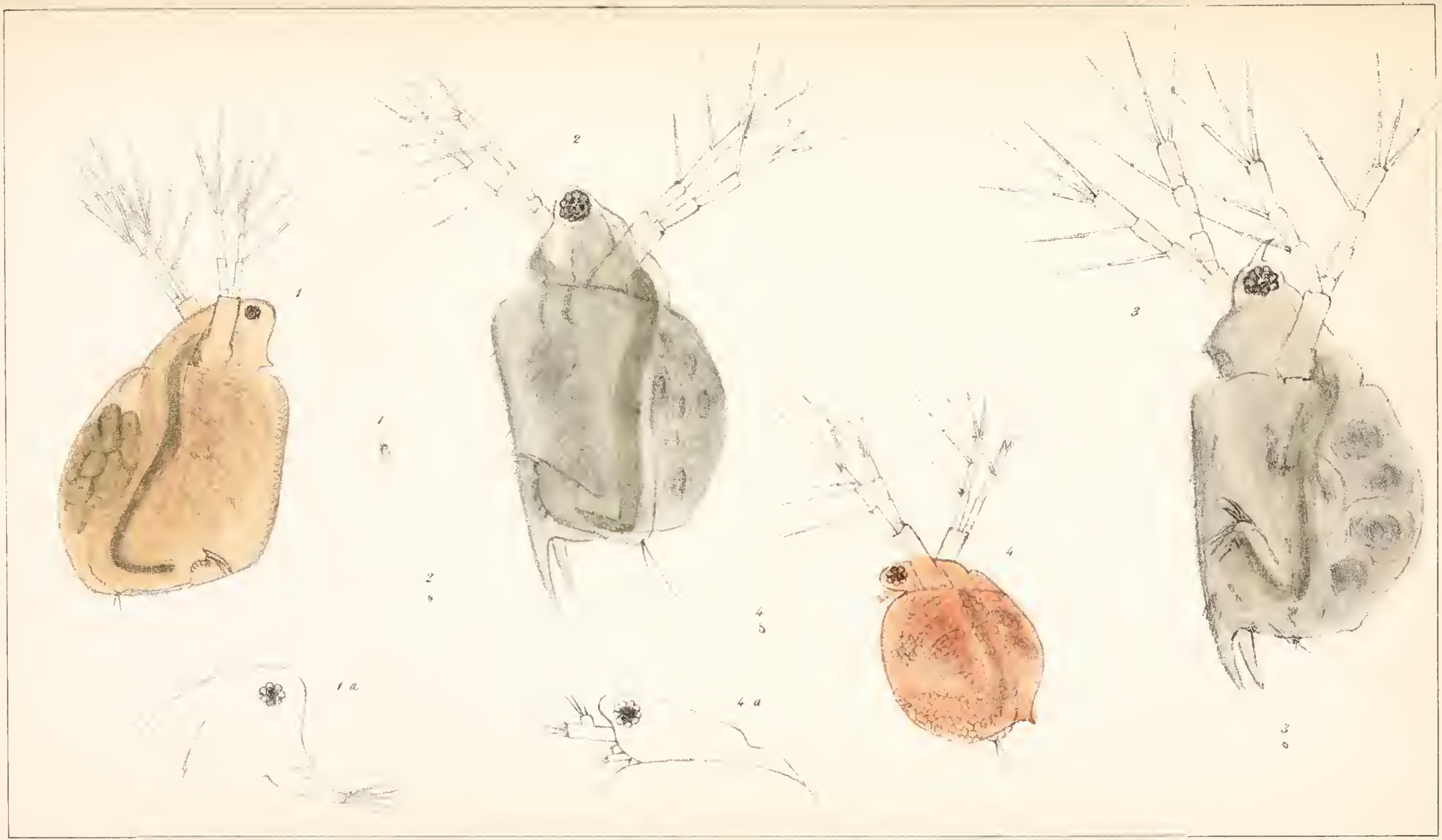


D^r^ Baird del W Wing lith.

Reeve Benham & Reeve imp

1. MOINA BRANCHIATA.
2. D^o^ JUN^R^
5 D PULEX JUN^R^
3. D. PSITTACEA.
4. D^o^ JUN^R^
6 D ROTUNDA JUN^R^

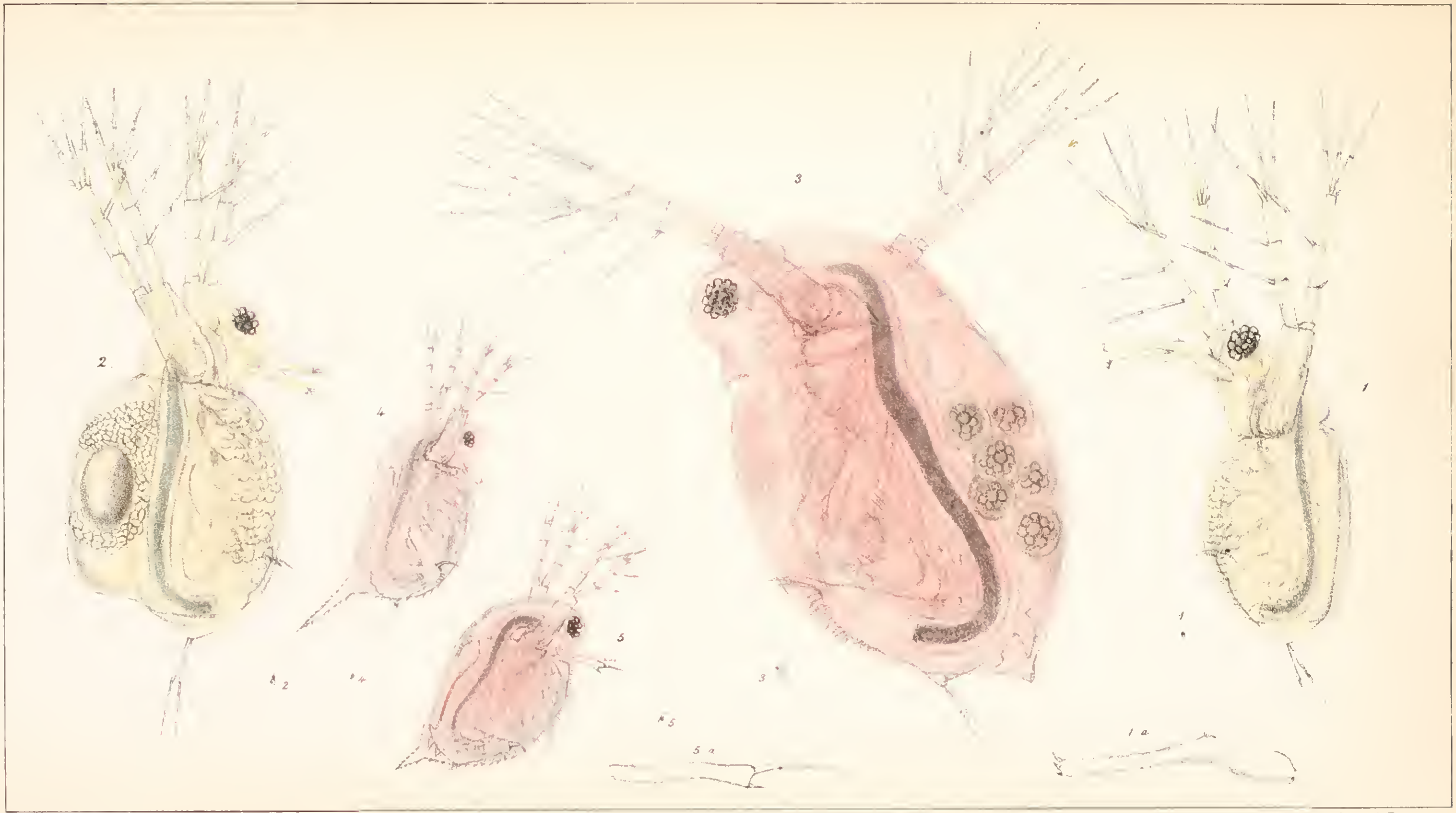
Tab. X.



Dr. Baird del. W Wing, lith.

Reeve Benham & Reeve imp.

1 DAPHNIA VETULA 2 & 3. D. MUCRONATA
4. D. ROTUNDA.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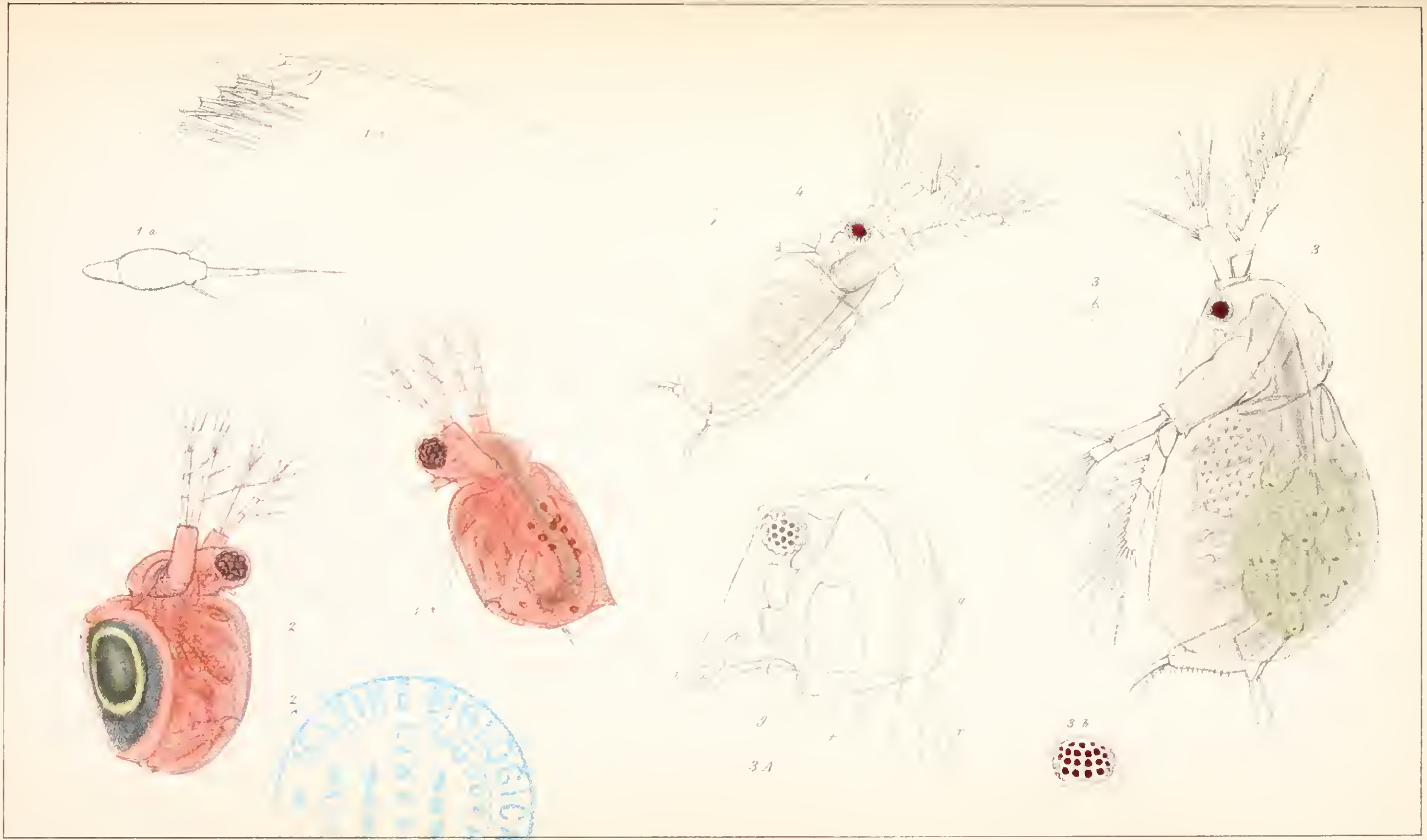
W. Wing. ad nat lith.

Reeve Benham & Reeve imp.

1 & 2 MOINA RECTIROSTRIS.
4 5 & 6. DAPHNIA PULEX. ♂ & ♀ var.

Tab. XII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W Wing ad nat lith

Reeve Benham & Reeve imp

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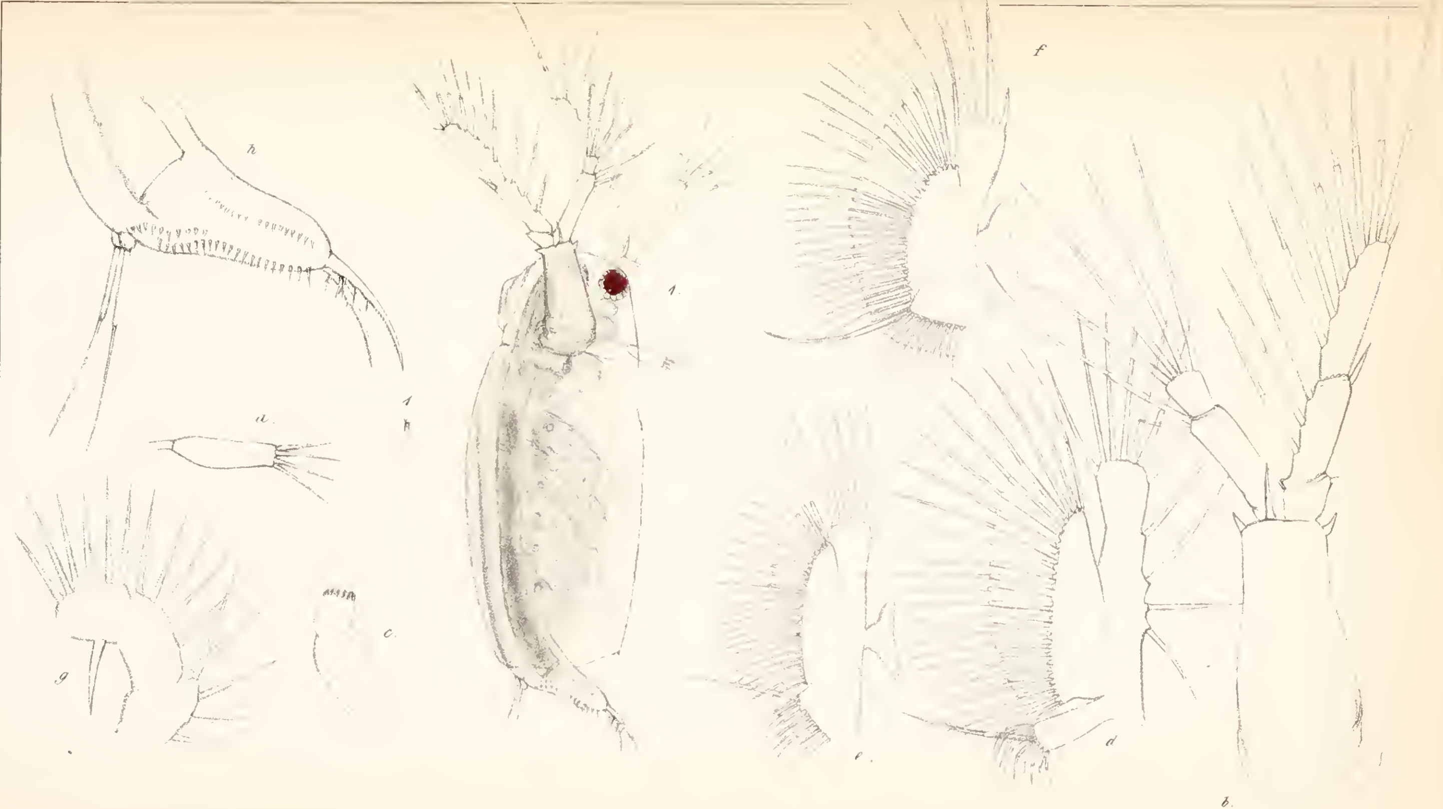
4 S. CRYSTALLINA JUNʳ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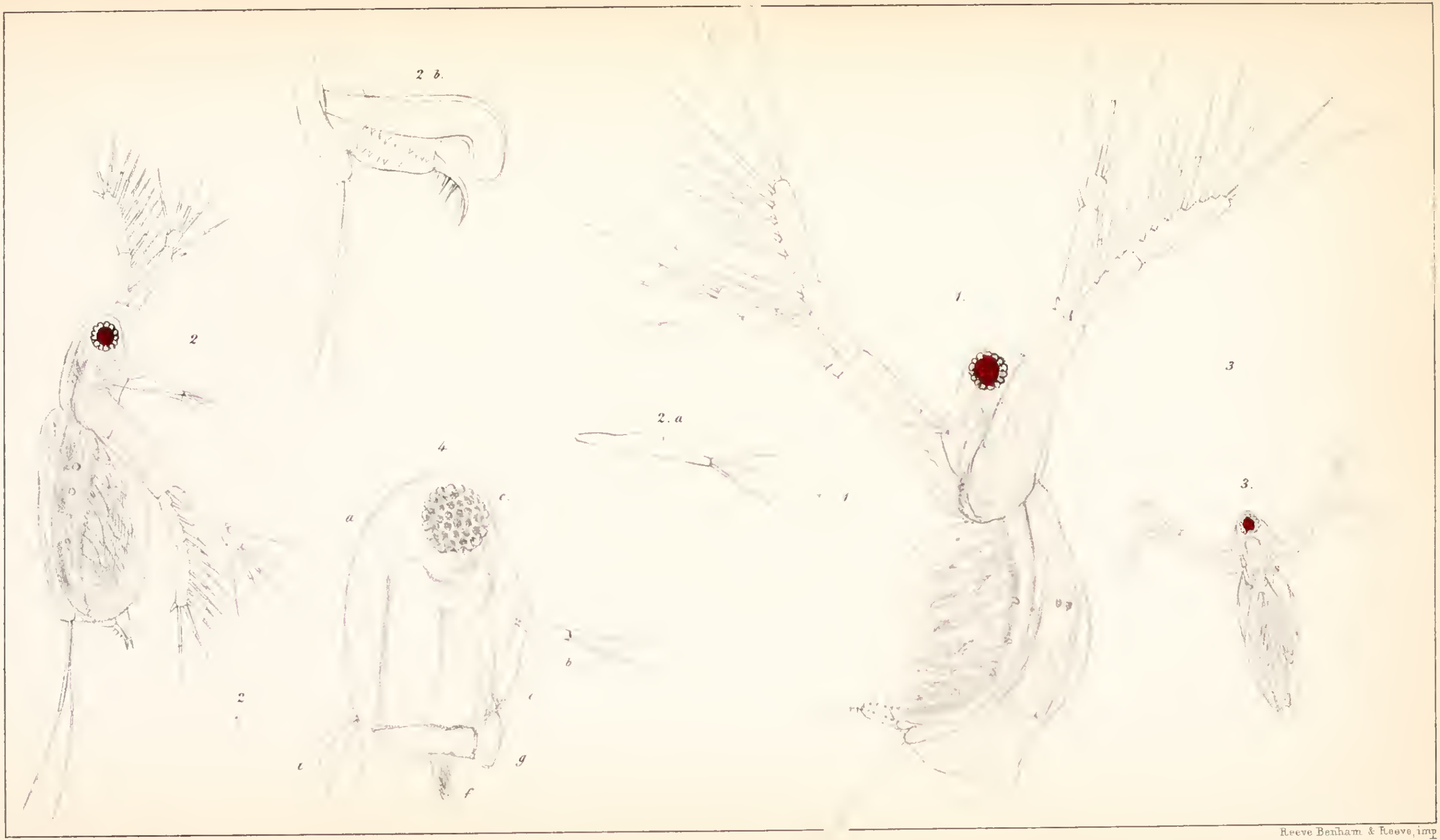
W. Wing del et Lith.

Reeve Benham & Reeve, imp.

SIDA CRYSTALLINA.

Tab. XIV.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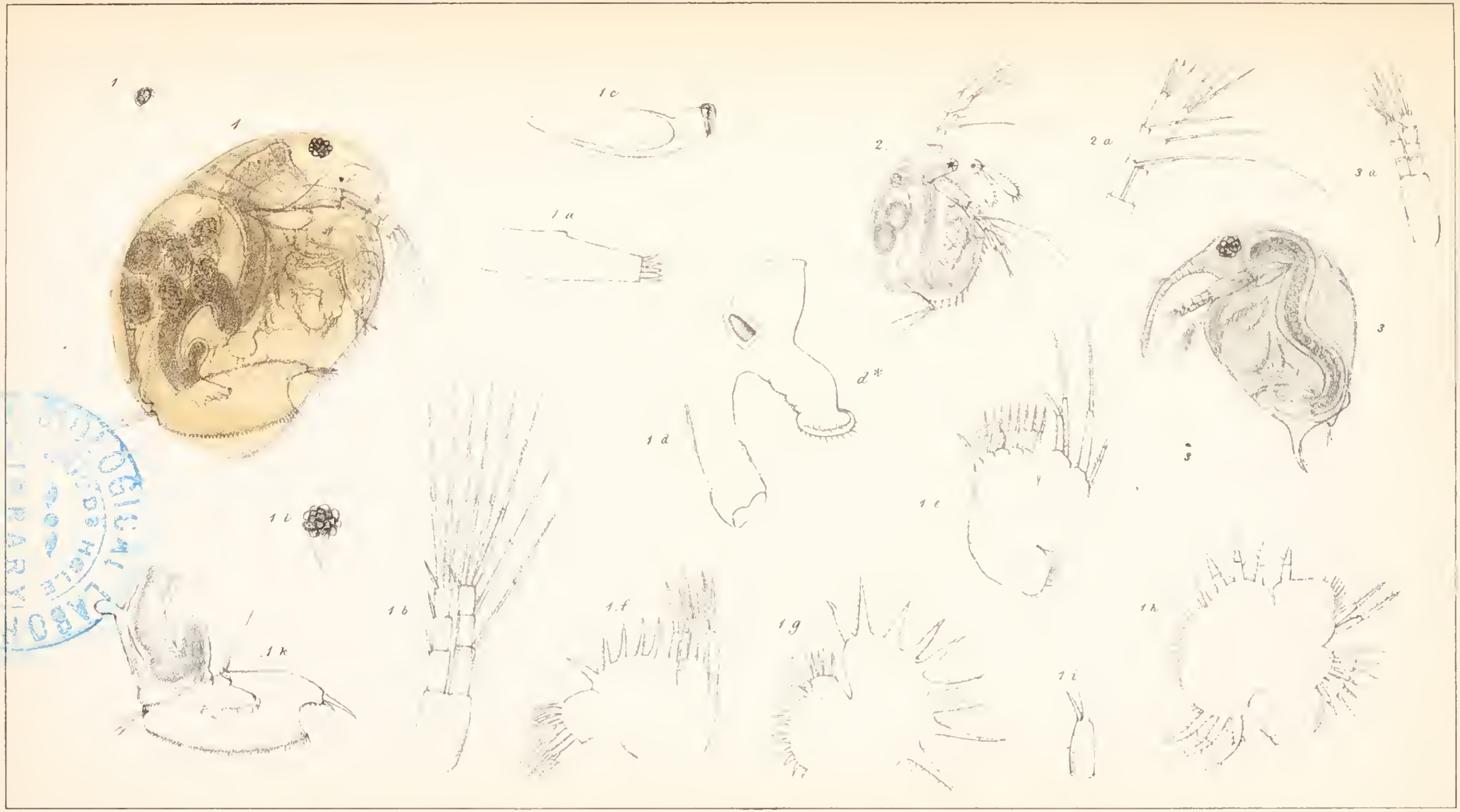
W. Wing ad nat lith.

Reeve Benham & Reeve, imp

DAPHNELLA WINGII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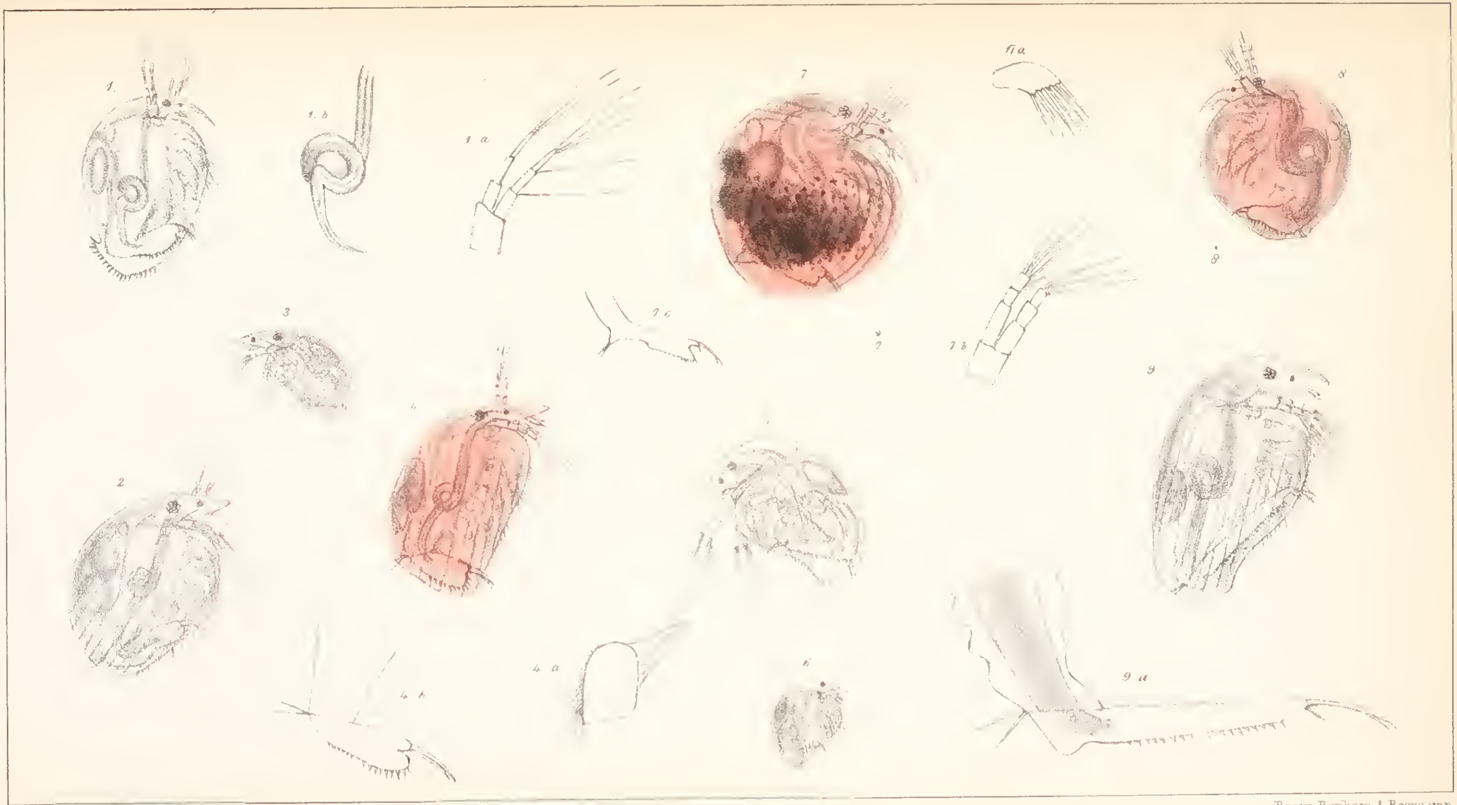
W Wing ad nat lith.

Reeve Benham & Reeve imp

1 EURYCERCUS LAMELLATUS. 2 MACROTHRIX LATICORNIS.
3 BOSMINA LONGIROSTRIS.

WOODS HOLE
LIBRARY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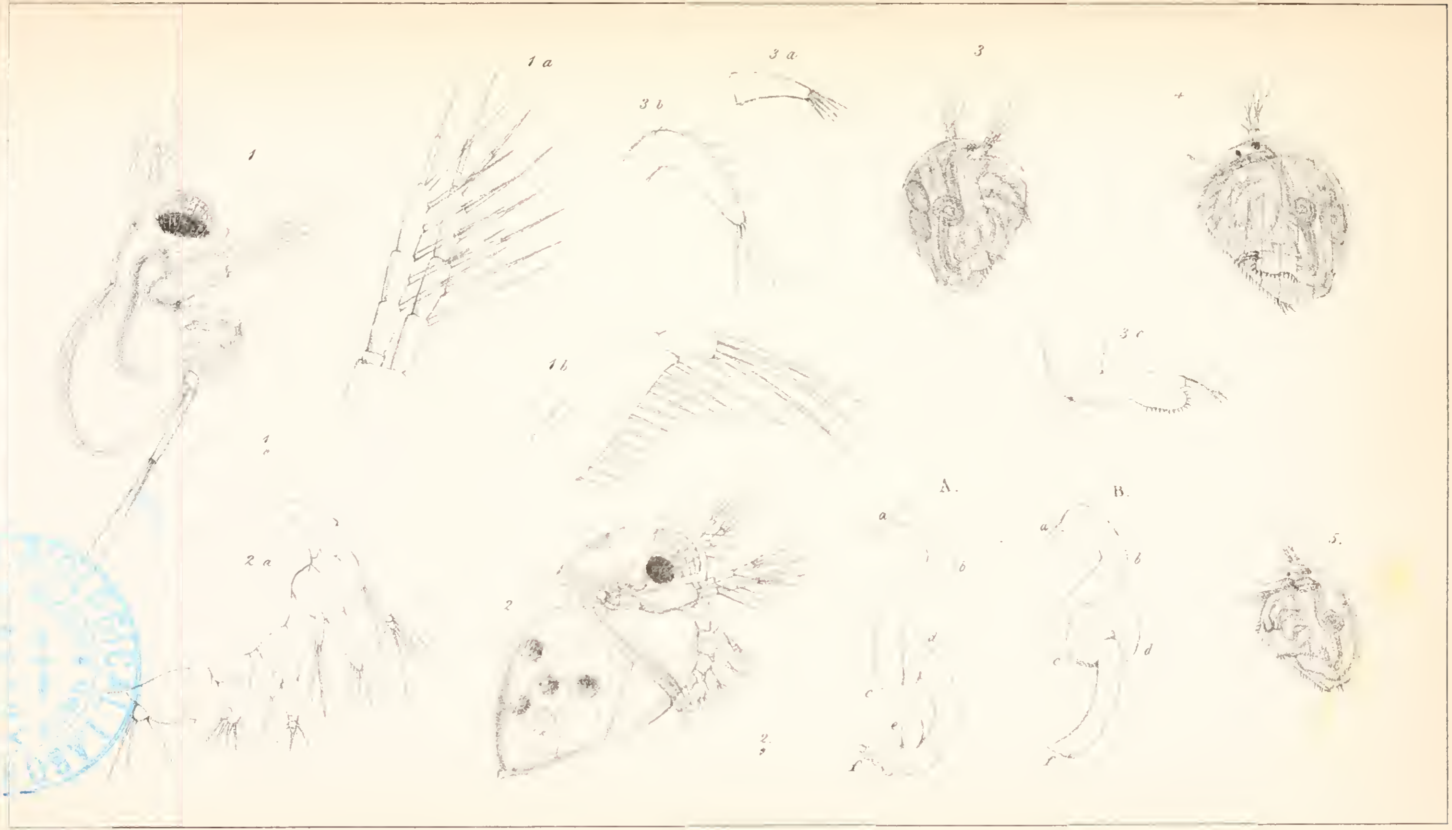
D^r Baird del W Wing lith.

Reeve Benham & Reeve imp

1. PERACANTHA TRUNCATA.
2. ALONA OVATA.
3. A RETICULATA.
4 A. QUADRANCULARIS
5. ACROPERUS HARPA
6 A. NANUS.
7 CHYDORUS GLOBOSUS
8. C. SPHÆRICUS
9 CAMPTOCERCUS MACROURUS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b
c
d

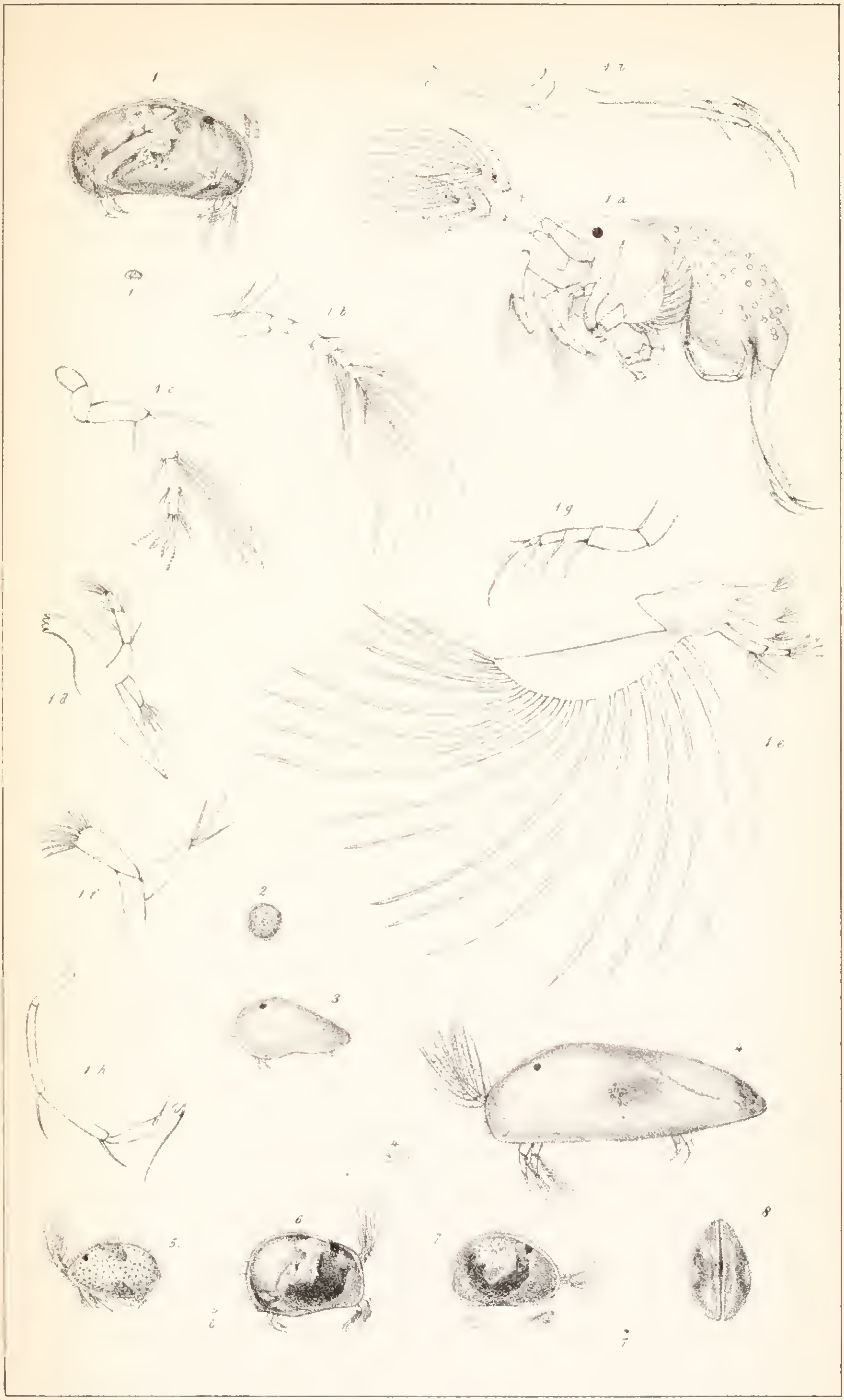
W. Wing ad nat lith.

Reeve Benham & Reeve imp

1. POLYPHEMUS PEDICULUS.
2 EVADNE NORDMANNI.

3 PLEUROXUS TRIGONELLUS.
4 P UNCINATUS.
5 P HAMATUS.

A. EURYCERCUS.
B. CHYDORUS
(Intestine)


1
1 i
1 a
1 b
1 c
1 d
1 e
1 f
1 g
1 h
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6
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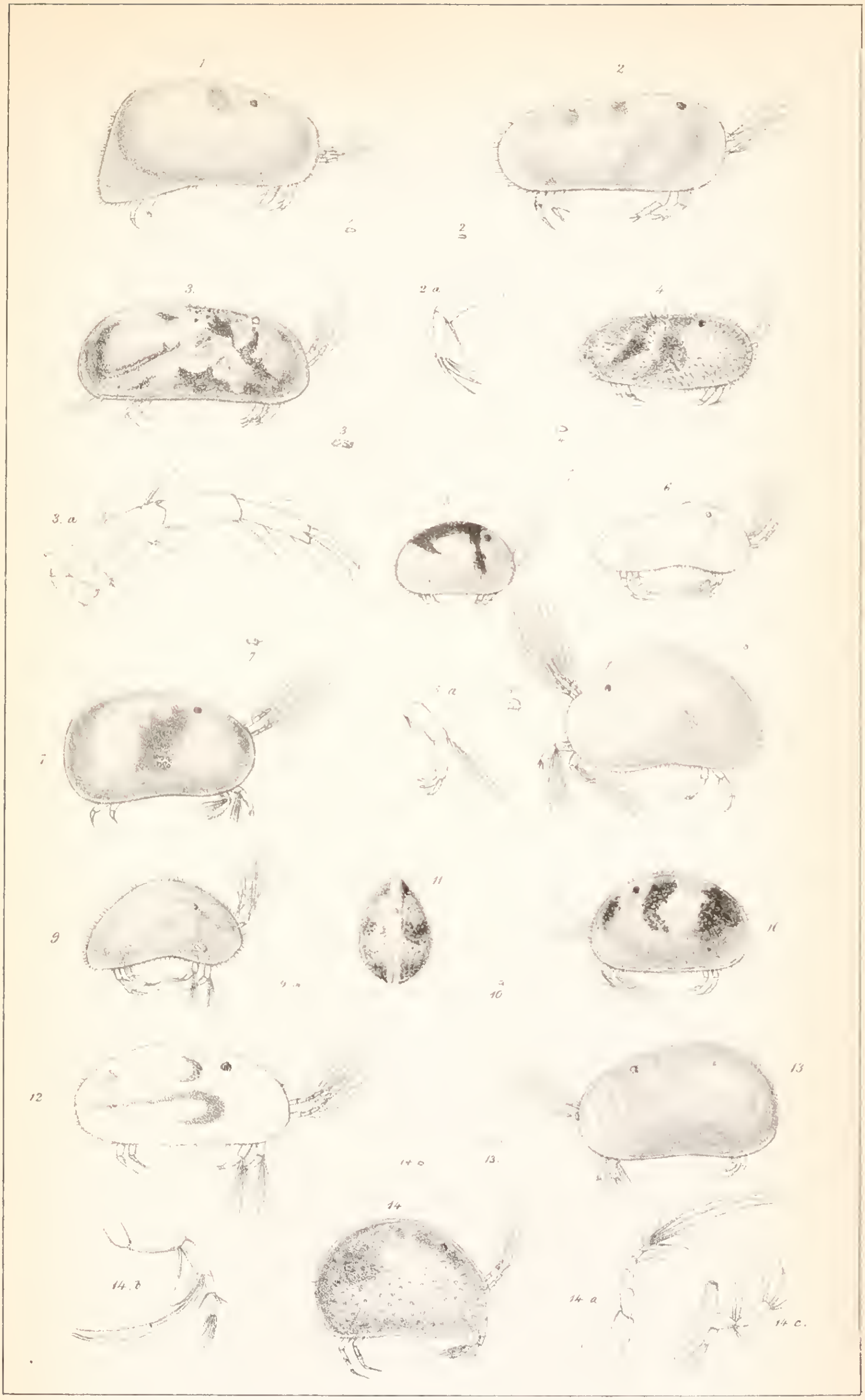
8

D^{r} Baird del. W Wing lith

Reeve Benham & Reeve imp

1 CYPRIS TRISTRIATA 5 C JOANNA
2 3 D^{o} JUN^{R} 6 C MONACHA.
4 C CLAVATA 7. 8 C MINUTA

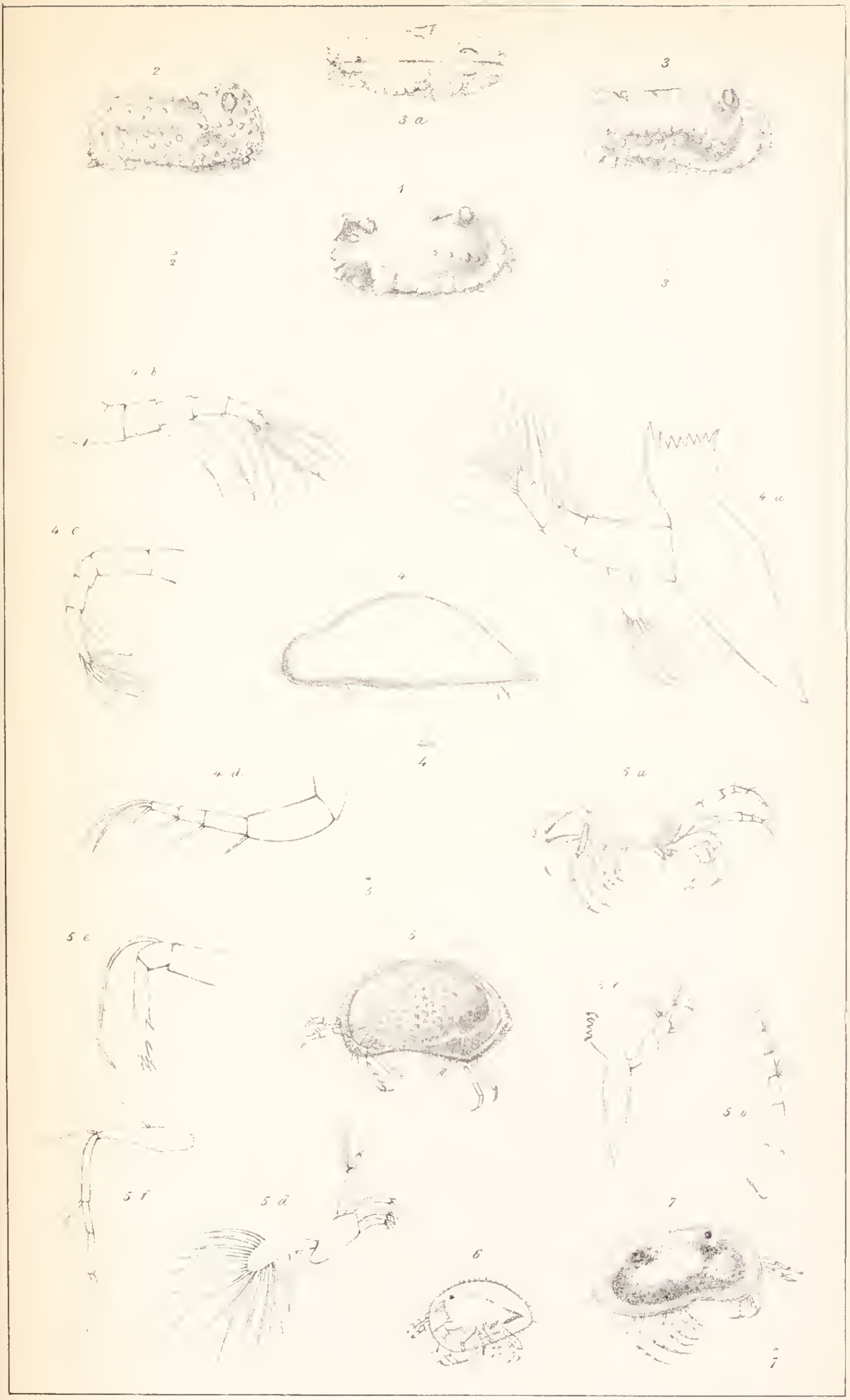
Tab XIX.


1
2
2
6
3.
2 a
4
3
3. a
6
7
8
8 a
7
9
11
11
9 a
10
12
13
14 a
13.
14
14. b
14 a
14 c.

1. CANDONA LUCENS.
2. C. SIMILIS.
3. C. REPTANS
4. C. HISPIDA.
5. CYPRIS SELLA
6. C. ELONGATA.
7. C. FUSCA.
8. C. GIBBOSA.
9. C. WESTWOODII
10. 11. C. VIDUA.
12. C. ELLIPTICA.
13. C. AURANTIA.
14. C. COMPRESSA.

W. Baird del. W. Wing lith.

Reeve Benham & Reeve imp.

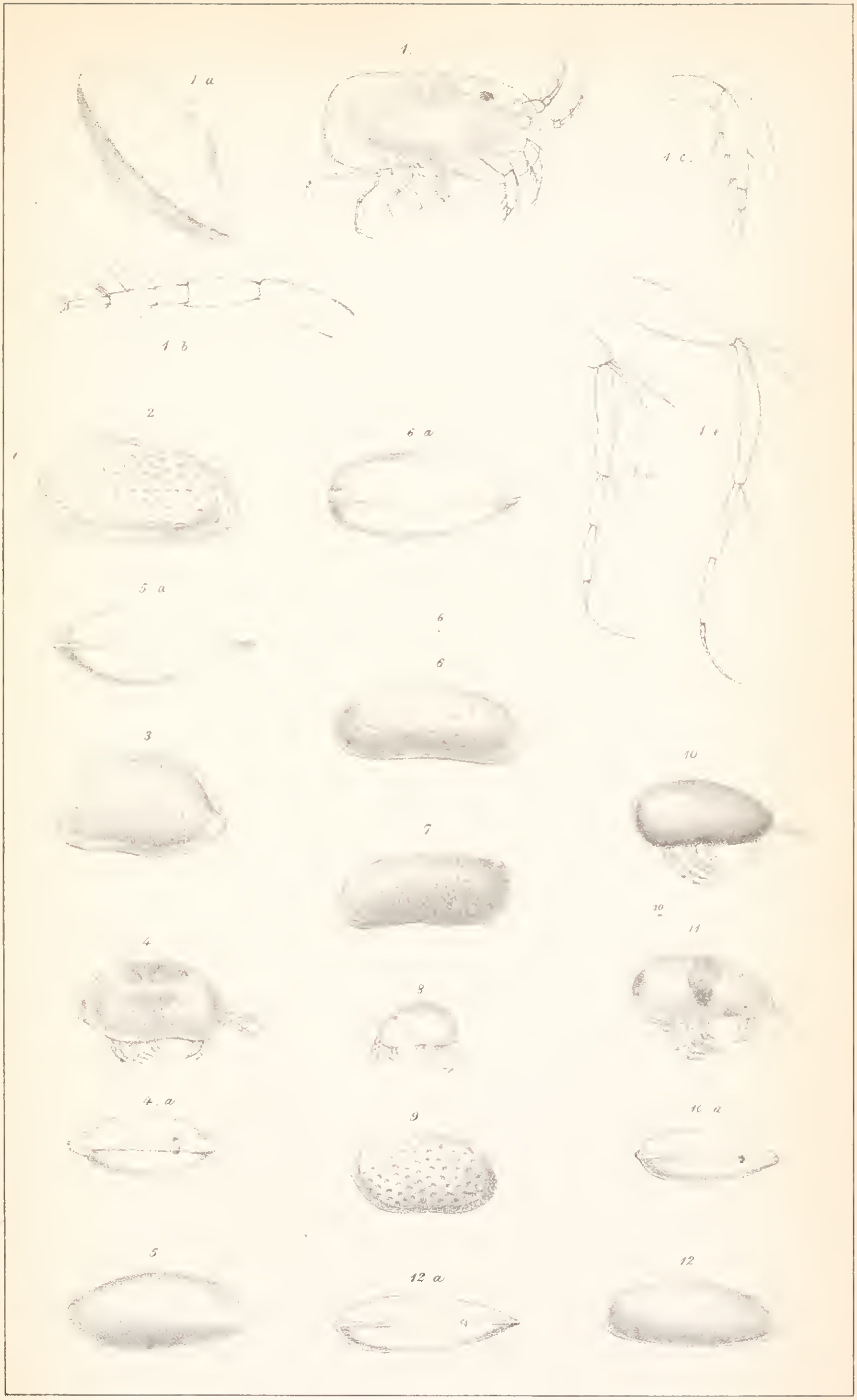


3 a
2
3
1
2
3
4 b
4 a
4 c
4
4
4 d
5 a
5
5 c
5
5 f
5 b
5 f
5 d
7
6
7

1. CYTHEREIS JONESII
2. C ANTIQUATA
3. C WHITEII.
4 CYTHERE MINNA
5. C. RENIFORMIS.
6. C. ALBA
7 C. ALBOMACULATA.

Dr Baird del. W Wing lith.

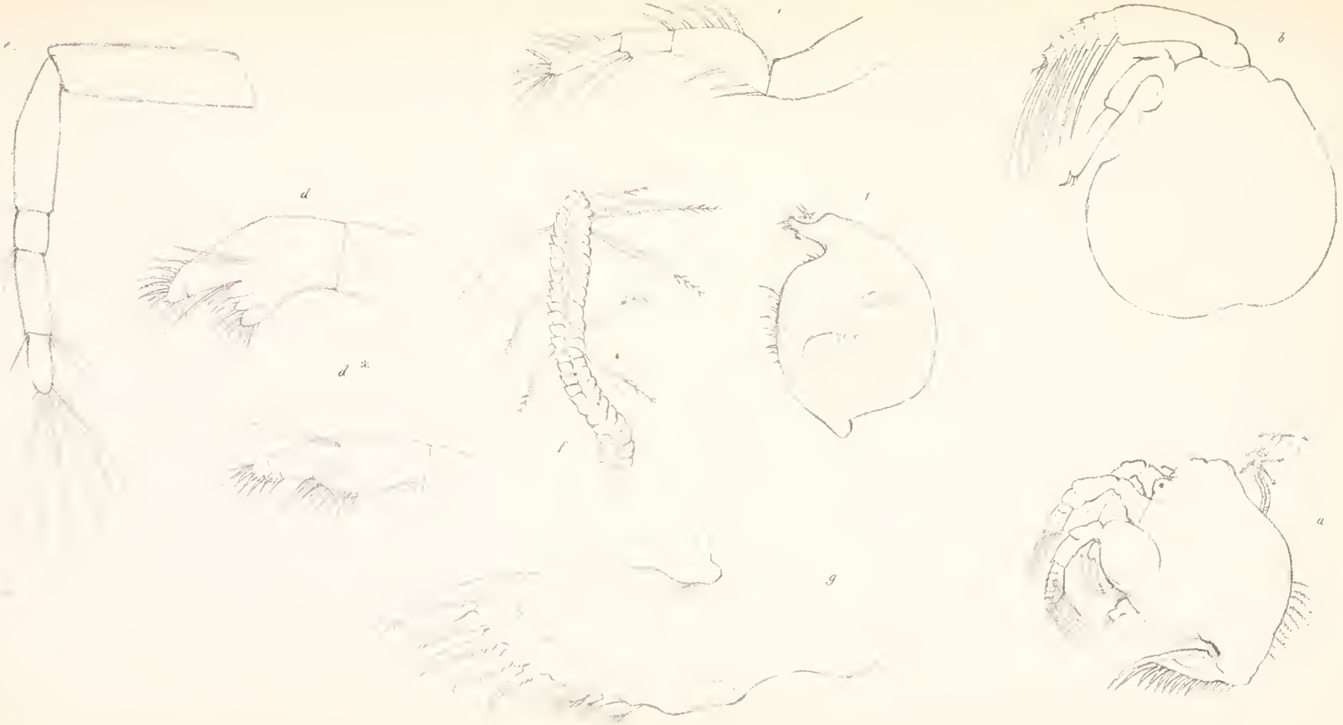
Reeve Benham & Reeve imp


1.
1 a
1 c.
1 b
2
6 a
1 e
5 a
6
6
3
10
7
10
11
4
8
4. a
9
11 a
5
12 a
12

1 CYTHERE INOPINATA 5. C ACUTA 9 C IMPRESSA
2 C. QUADRIDENTATA 6 C ANGUSTATA 10 11. C. VARIABILIS.
3 C. CONVEXA 7 C PELLUCIDA 12 C. FLAVIDA.
4 C NIGRESCENS. 8. C AURANTIA

W Wing ad nat lith.

Reeve Benham & Reeve imp

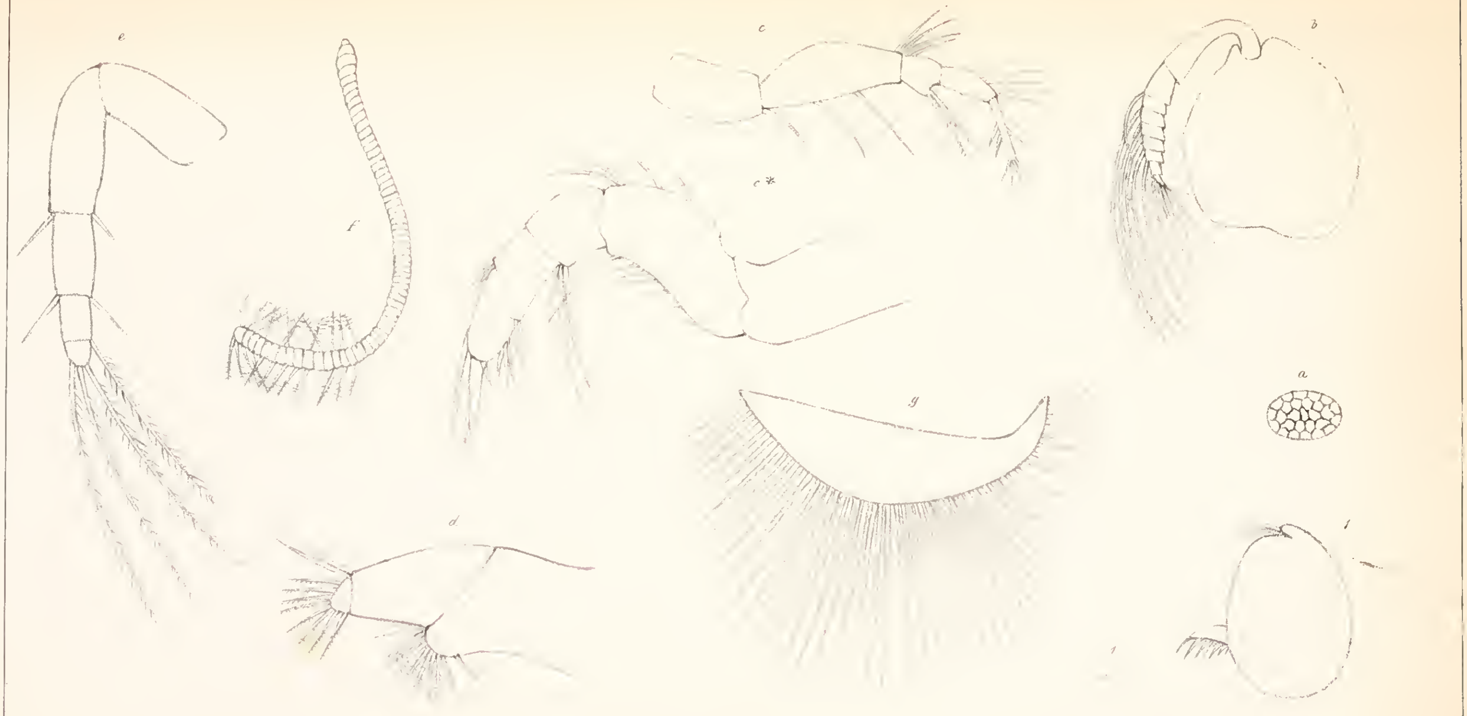


Dr Baird del. W. Wing lith.

Reeve Benham & Reeve imp.

CYPRIDINA MAC-ANDREI

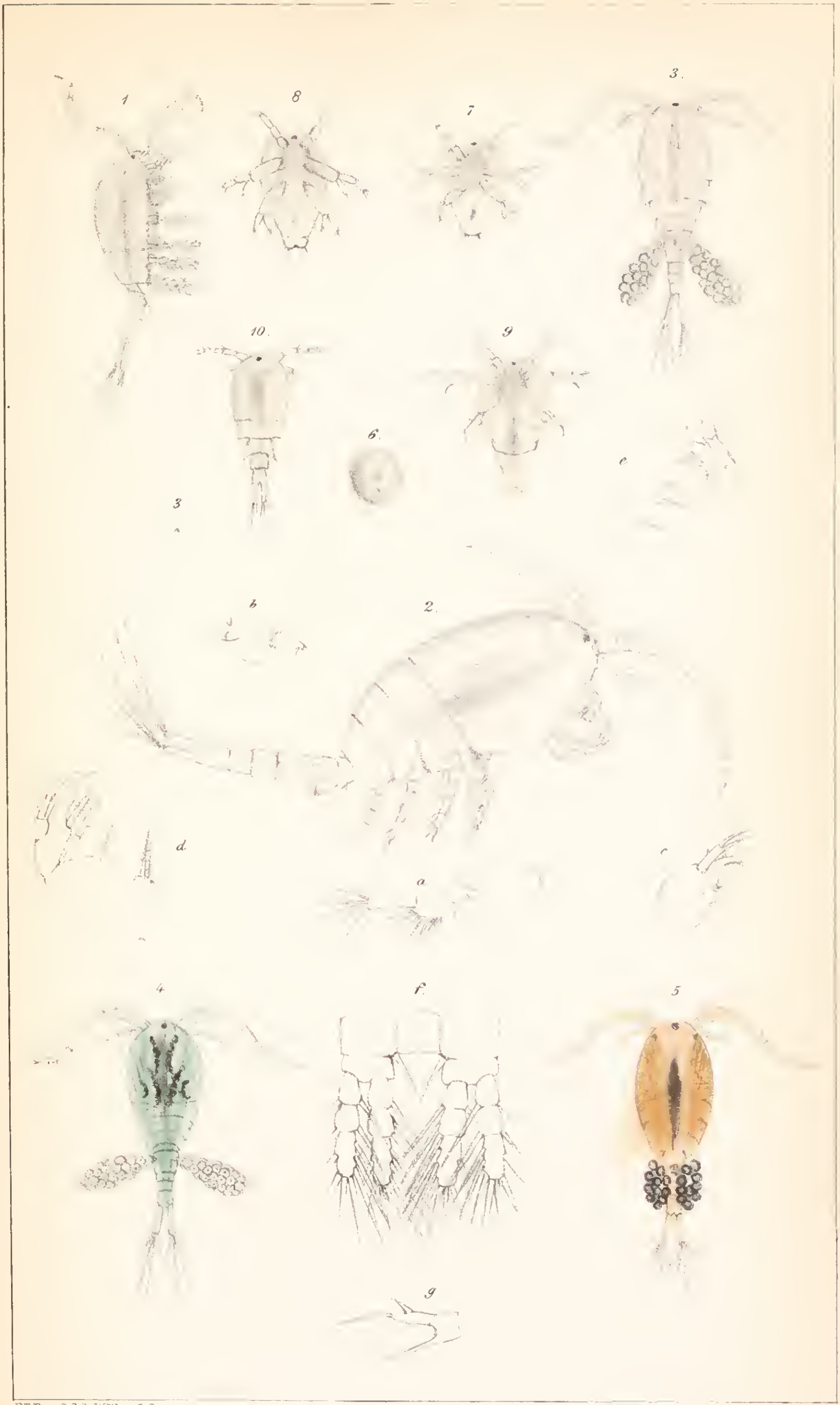
Tab. XXIII.


e
f
c
c*
b
d
g
a
1
1

Dr. Baird del. W. Wing lith.

Reeve Benham & Reeve imp.

CYPRIDINA BRENDA

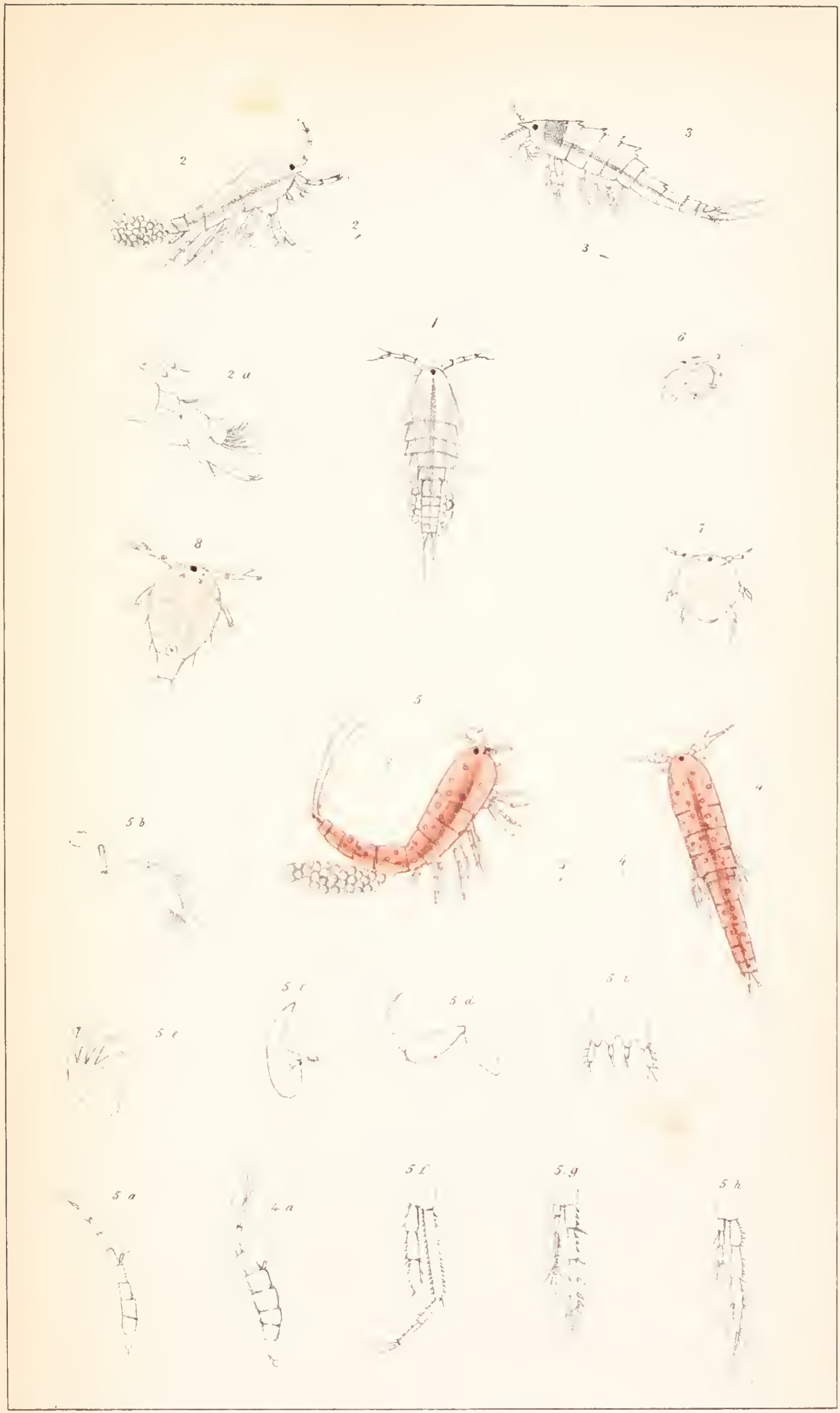

1
8
7
3.
10.
9
6.
e
3
b
2.
d
a
c
4
f.
5
g

Dr Baird del. W Wing lith.

Reeve Benham & Reeve imp

CYCLOPS QUADRICORNIS

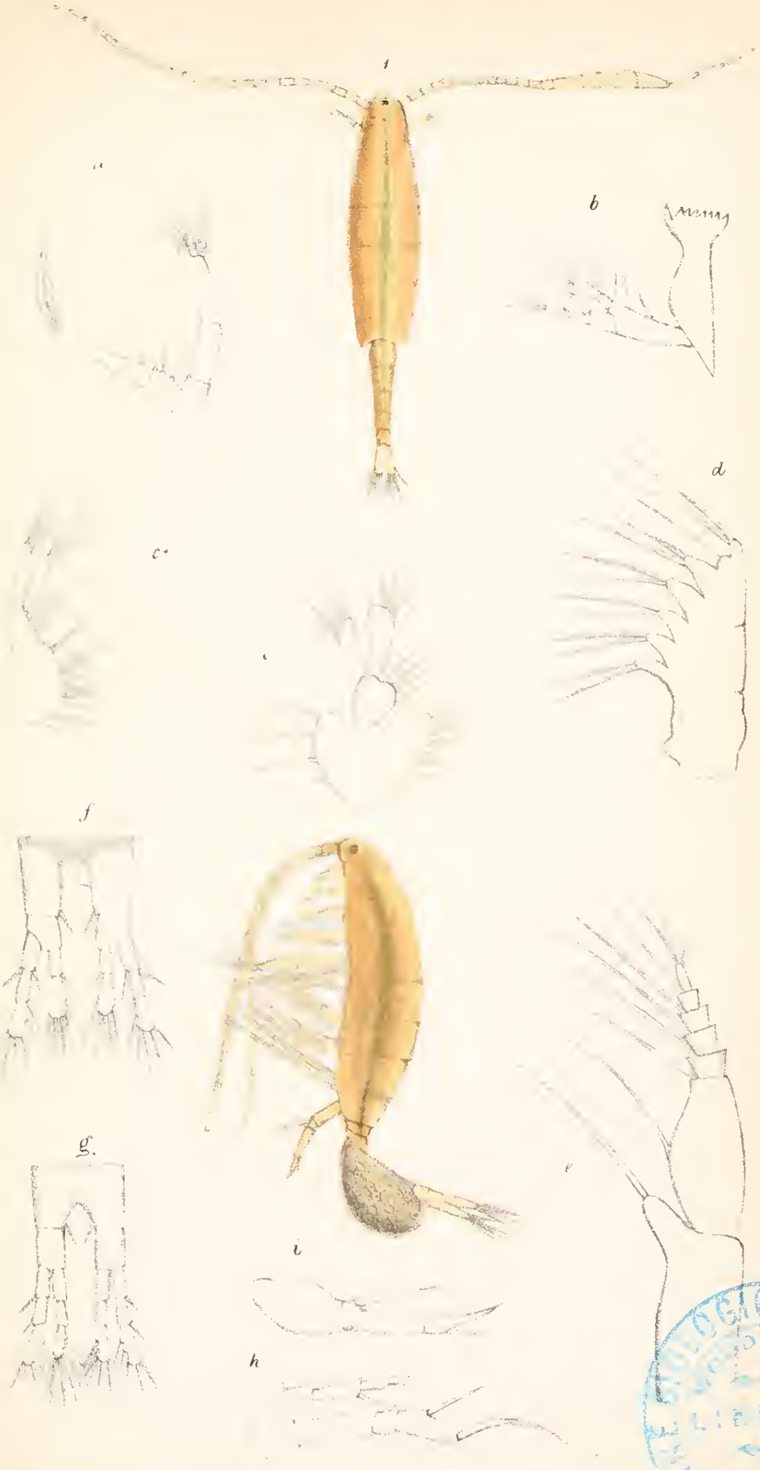
Tab XXV.


2
3
2
3
1
2 a
6
8
7
5
5 b
4
4
5 c
5 d
5 i
7
5 e
5 a
4 a
5 f
5 g
5 h

Dr. Baird del. W. Wing lith.

Reeve Benham & Reeve imp.

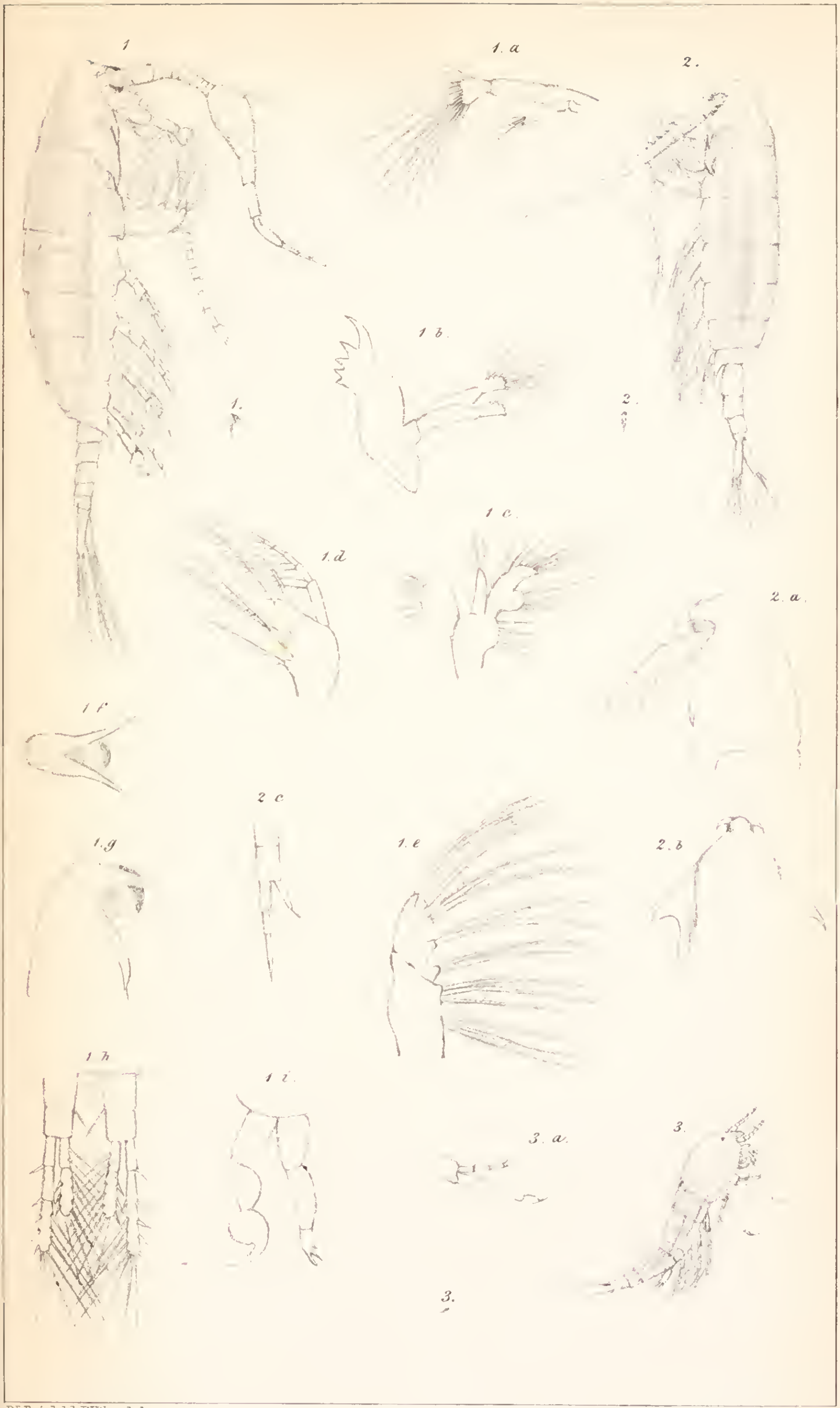
1 & 2 CANTHOCAMPTUS FURCATUS.
3 " " " MINUTICORNIS.
4 & 8 " " " MINUTUS


1
a
b
c
d
c
f
g.
e
i
h

[illegible]

DIAPTOMUS CASTOR

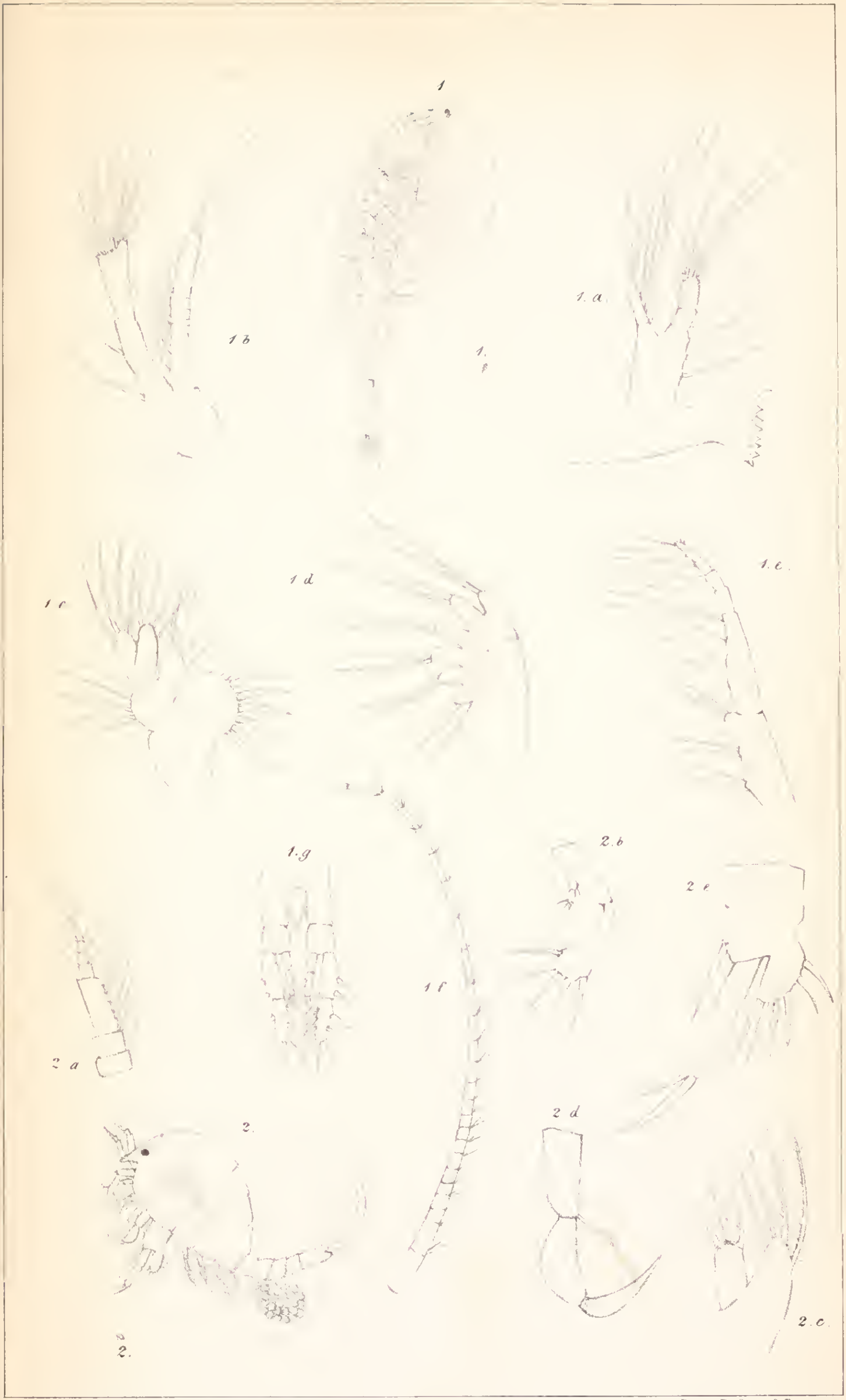
MARINE BIOLOGICAL LABORATORY
WOODS HOLE
LIBRARY
MASS


1
1. a
2.
1 b.
1.
2.
1 c.
1. d
2. a.
1 f.
2 c
1. g
1. e
2. b
1 h
1 i.
3. a.
3.
3.

Dr Baird del. W.Wing lith
Reeve Benham & Reeve imp

1—2. ANOMALOCERA PATERSONII.
3. CANTHOCAMPTUS STROMII.

Tab. XXVIII.

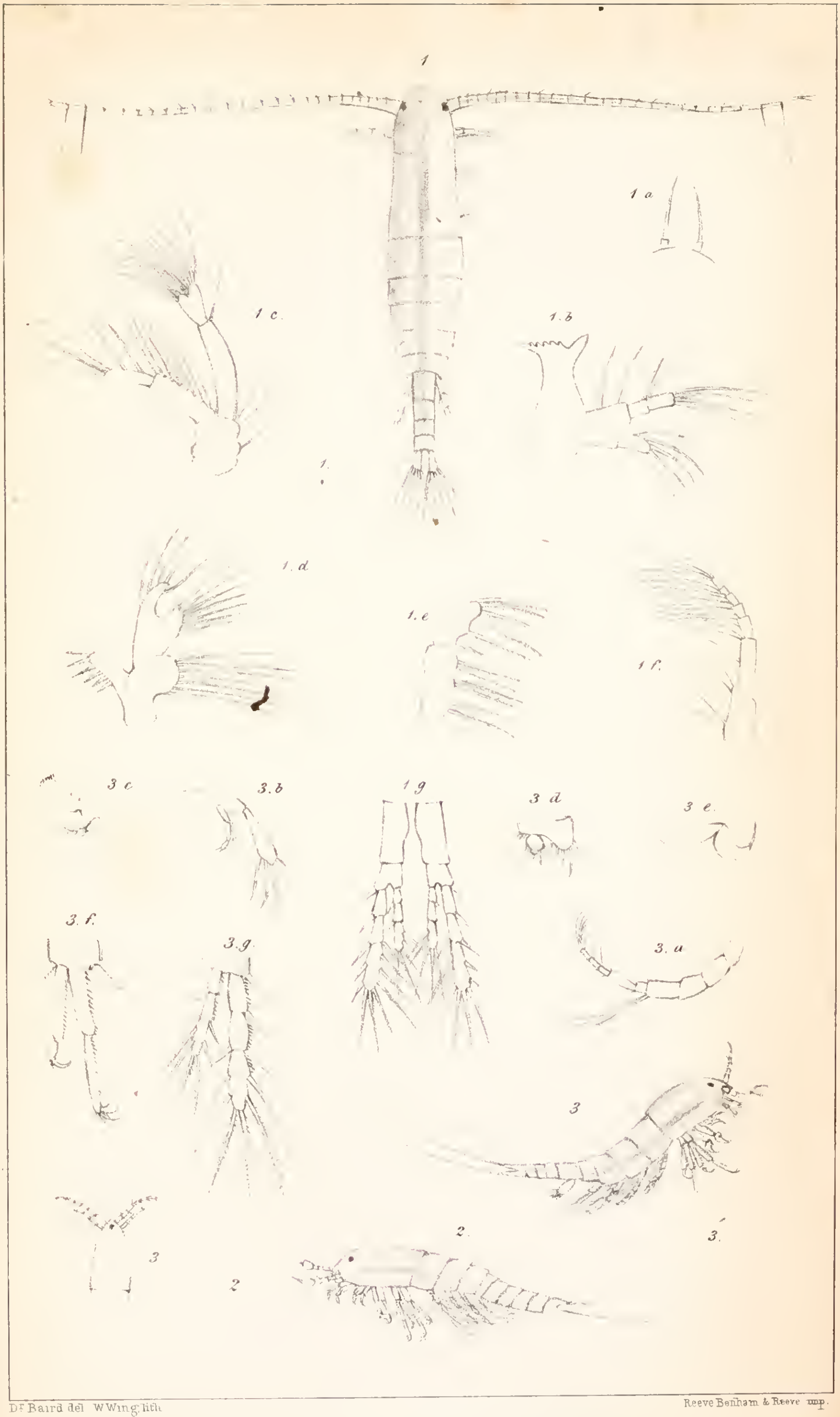

1
1.a.
1 b
1.
1 c
1 d
1.e.
1.g
1 f
2.b
2 e
2 a
2.
2.
2 d
2.c.

Dr Baird del. W Wing lith.

Reeve Benham & Reeve imp

1. TEMORA FINMARCHICA
2. ARPACTICUS NOBILIS

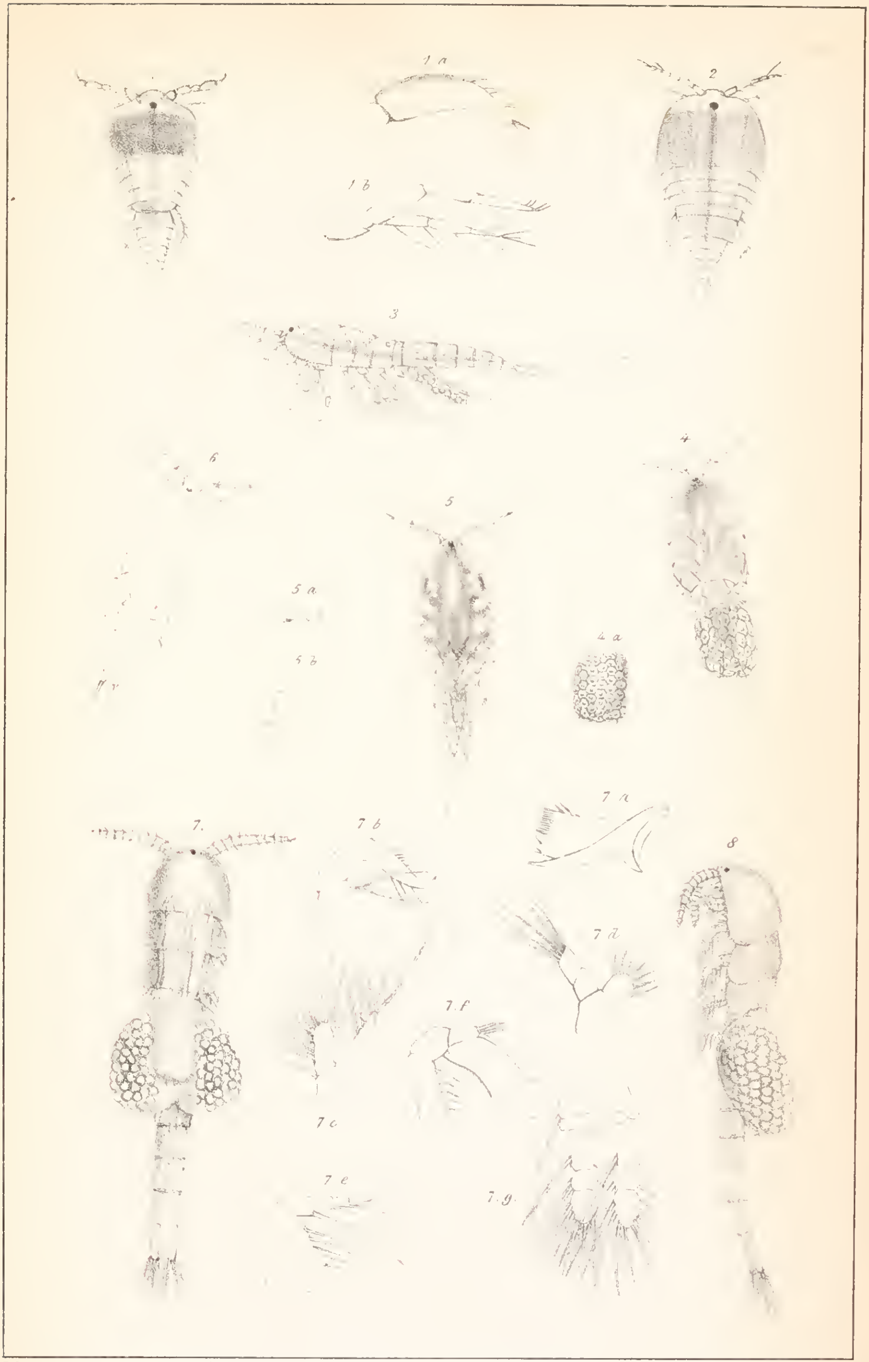
Tab. XXIX.


1
1 a
1 c.
1. b
1.
1. d
1. e
1 f.
3 c
3. b
1 g
3 d
3 e.
3. f.
3. g.
3. a
3
3
2.
3.
3
2

Dr Baird del W Wing lith

Reeve Benham & Reeve imp.

1 CETOCHILUS SEPTENTRIONALIS.
2. ARPACTICUS CHELIFER.


1 a
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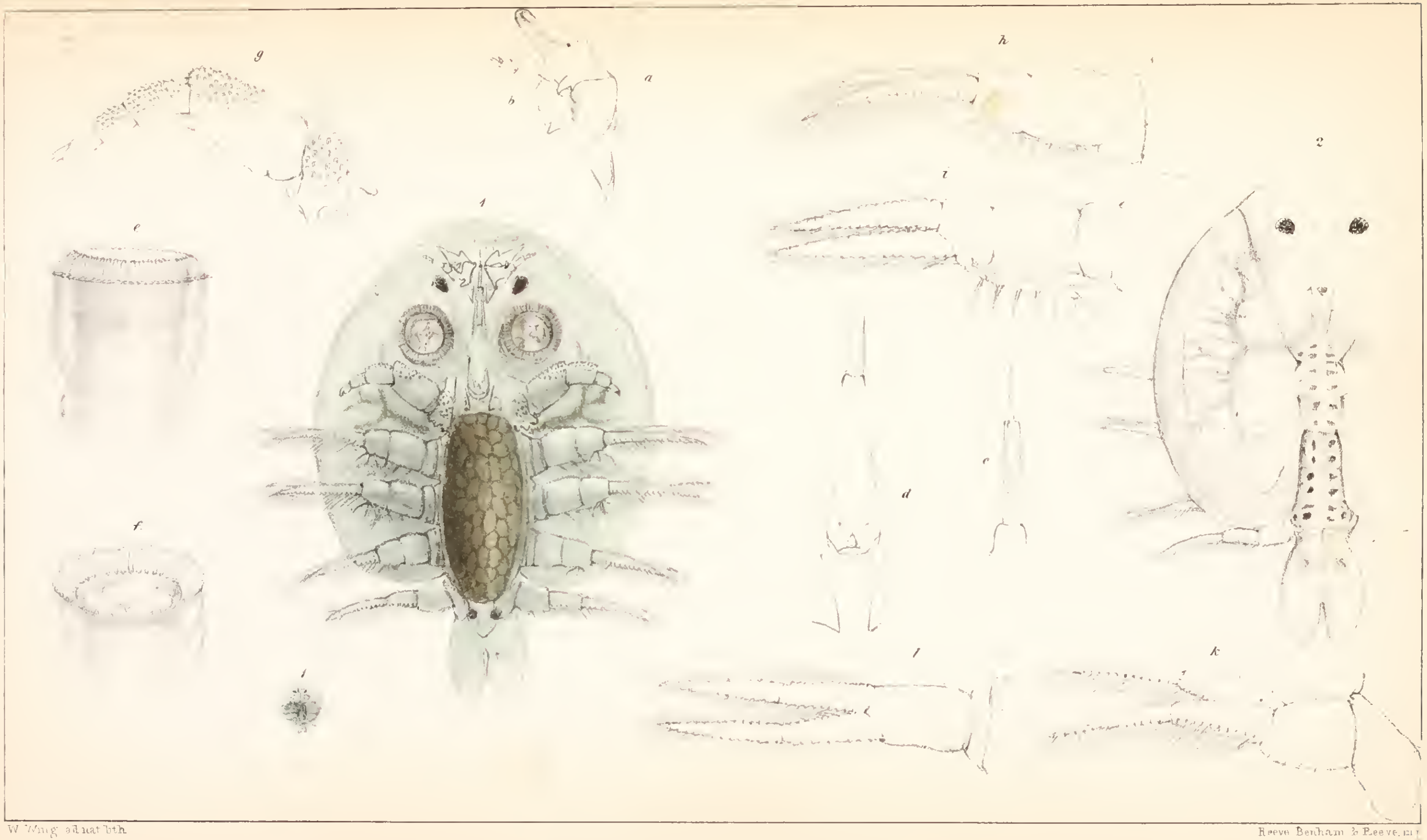
1 b
3
6
4
5
5 a
5 b
4 a
7.
7 b
7 a
8
7 d
7 f
7 c
7 e
7 g

Dr Baird. Mr Salter del. W Wing, lith.

Reeve Benham & Reeve imp.

1♂ 2♀ ALIEUTHA DEPRESSA.
3♀ CANTHOCAMPTUS MINUTUS.
4.5.6. C. FURCATUS.
7.8. NOTODELPHYS ASCIDICOLA.

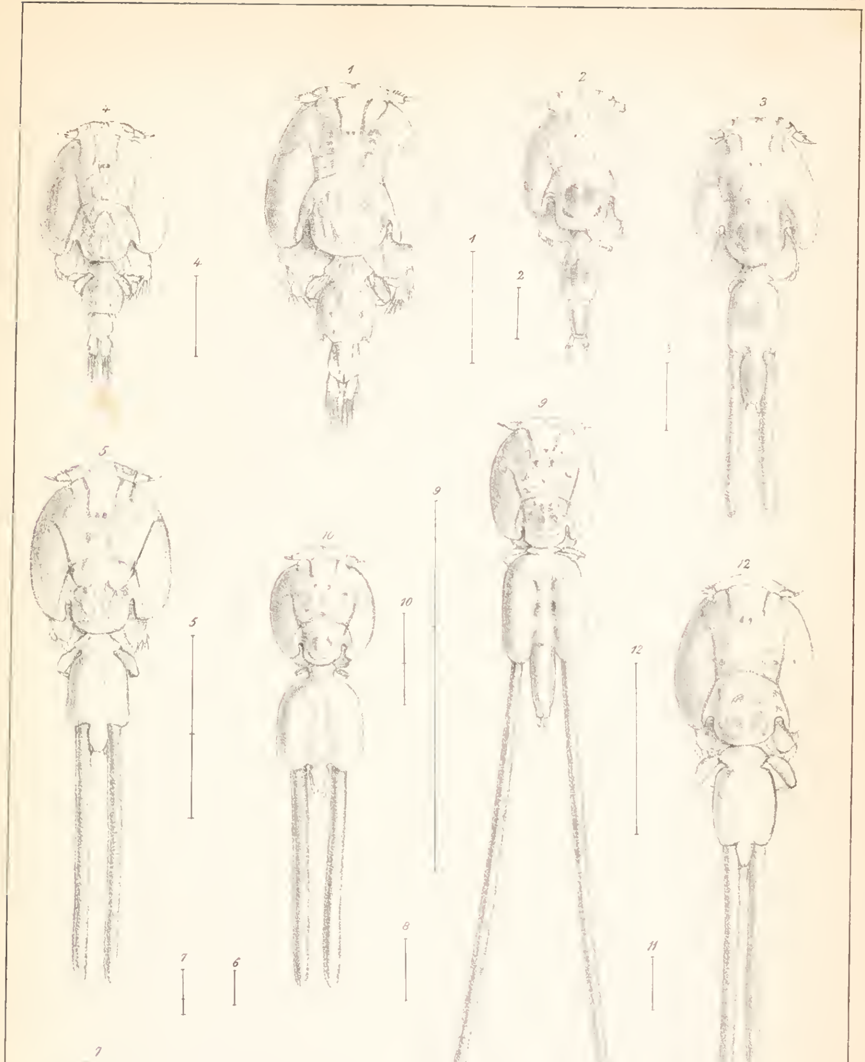

g
b
a
h
2
e
1
i
c
c
d
f
1
l
k

W Wing ad nat lith

Reeve Benham & Reeve imp

ARGULUS FOLIACEUS

Tab XXXII.

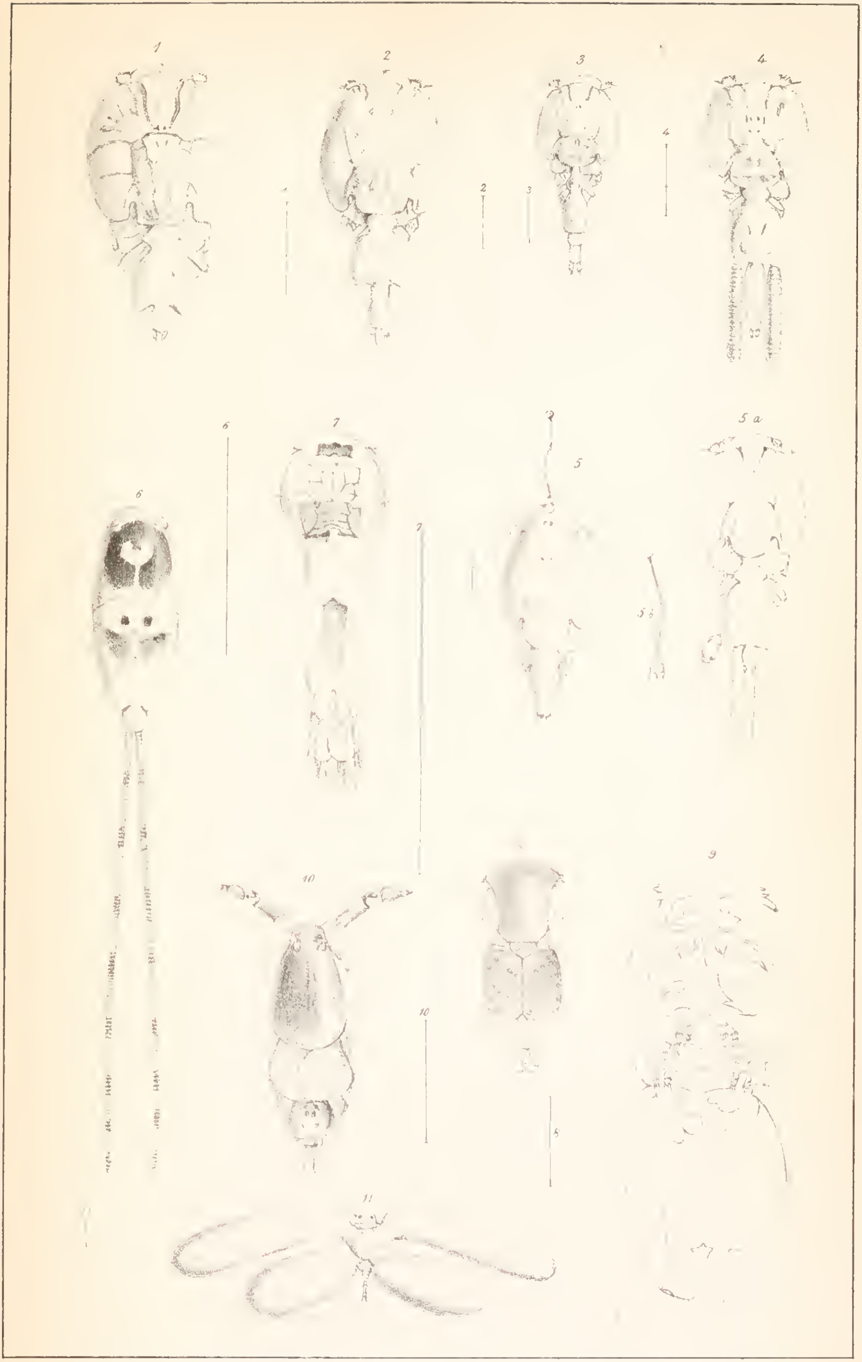


1 ♂ GALICUS DIAPHANUS
2 ♂ 3 ♀ C RAPAX.
4 ♂ 5 ♀ C MULLERI
6 ♂ 7 ♀ C.CENTRODONTI

8 ♂ 9 ♀ LEPEOPTHEIRUS STROMII
10 ♀ L PECTORALIS
11 ♀ L OBSCURUS
12 ♀ L HIPPOGLOSSI

W Wing ad nat lith.

Reeve Benham & Reeve imp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5 b
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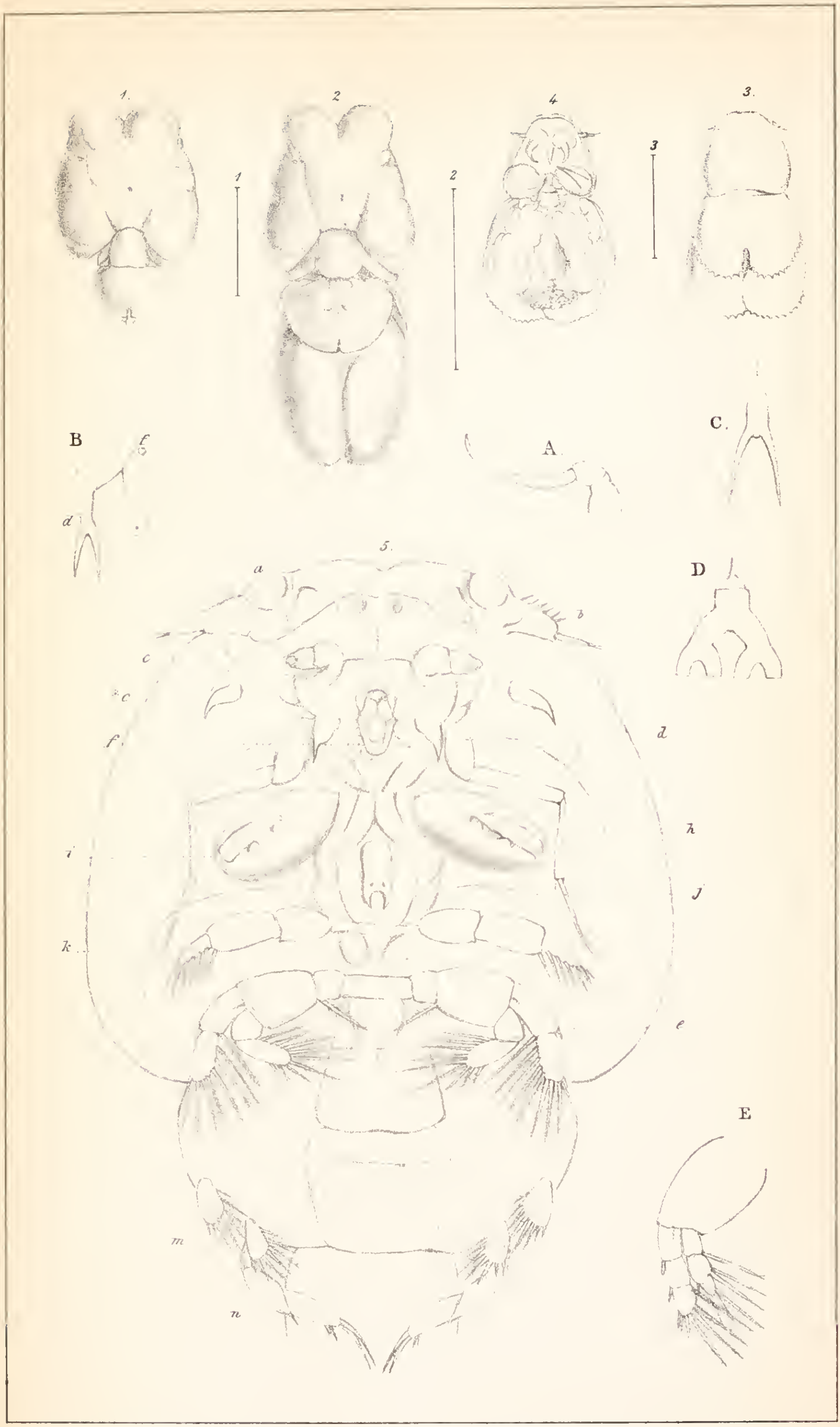
11

1 ♀ LEPEOPTHEIRUS NORDMANNII
2 ♀ L. THOMPSONI
3 ♂ 4 ♀ TREBIUS CAUDATUS.
5 ♂ CHALIMUS SCOMBRI.

6 ♀ PANDARUS BICOLOR
7 ♀ DINEMOURA LAMNÆ
8. 9 ♀ D ALATA
10 ♀ ANTHOSOMA SMITHII.
11 ♀ NICOTHÓE ASTACI

W Wing ad nat lith.


1.
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A.
C.
5.
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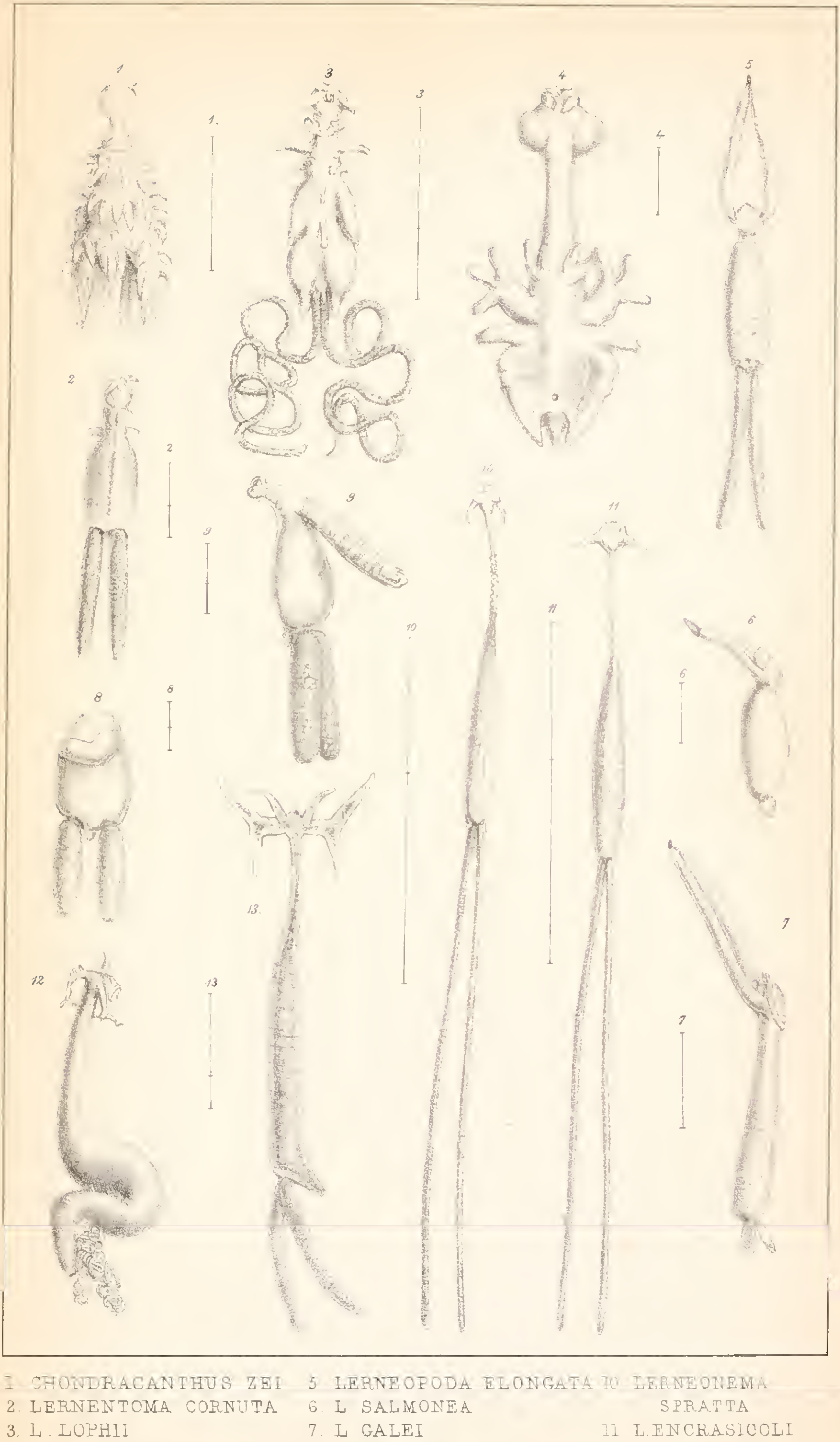
j
k
e
E
m
n

1. ♂ 2. ♀ CECROPS LATREILLEII. A.B.C. LEPEOPTHEIRUS NORDMANNI.
3 4. ♀ LÆMARCUS MURICATUS + D. L HIPPOCLOSSI.
+ 5 ♀ CALIGUS DIAPHANUS + E. TREBIUS CAUDATUS.

W Wing ad nat lith

Reeve Benham & Reeve, imp.

Tab XXXV.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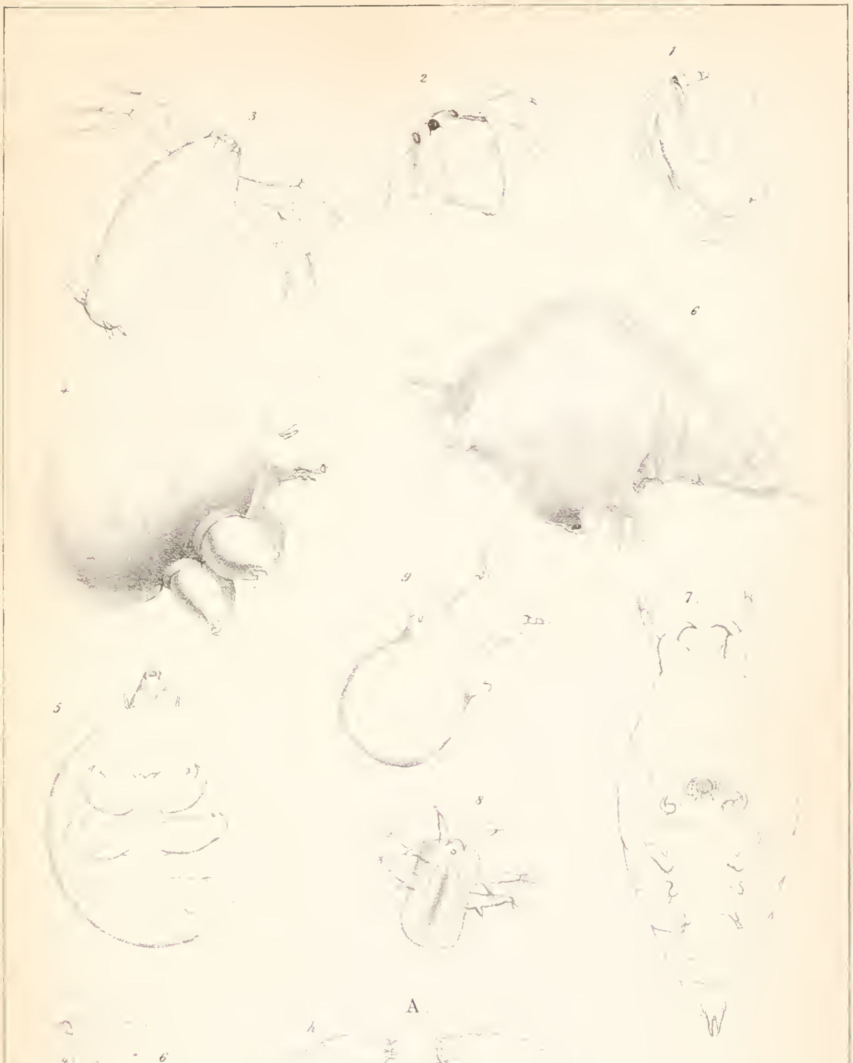
7

1. CHONDRACANTHUS ZEI
2. LERNENTOMA CORNUTA
3. L. LOPHII
4. L. ASELLINA
5. LERNEOPODA ELONGATA
6. L. SALMONEA
7. L. GALEI
8. ANCHORELLA RUGOSA
9. A. UNCINATA
10. LERNEONEMA SPRATTA
11. L. ENCRASICOLI
12. LERNEA BRANCHIALIS.
13. LERNEOCERA CYPRINACEA.

W. Wing, ad nat lith.


1
2
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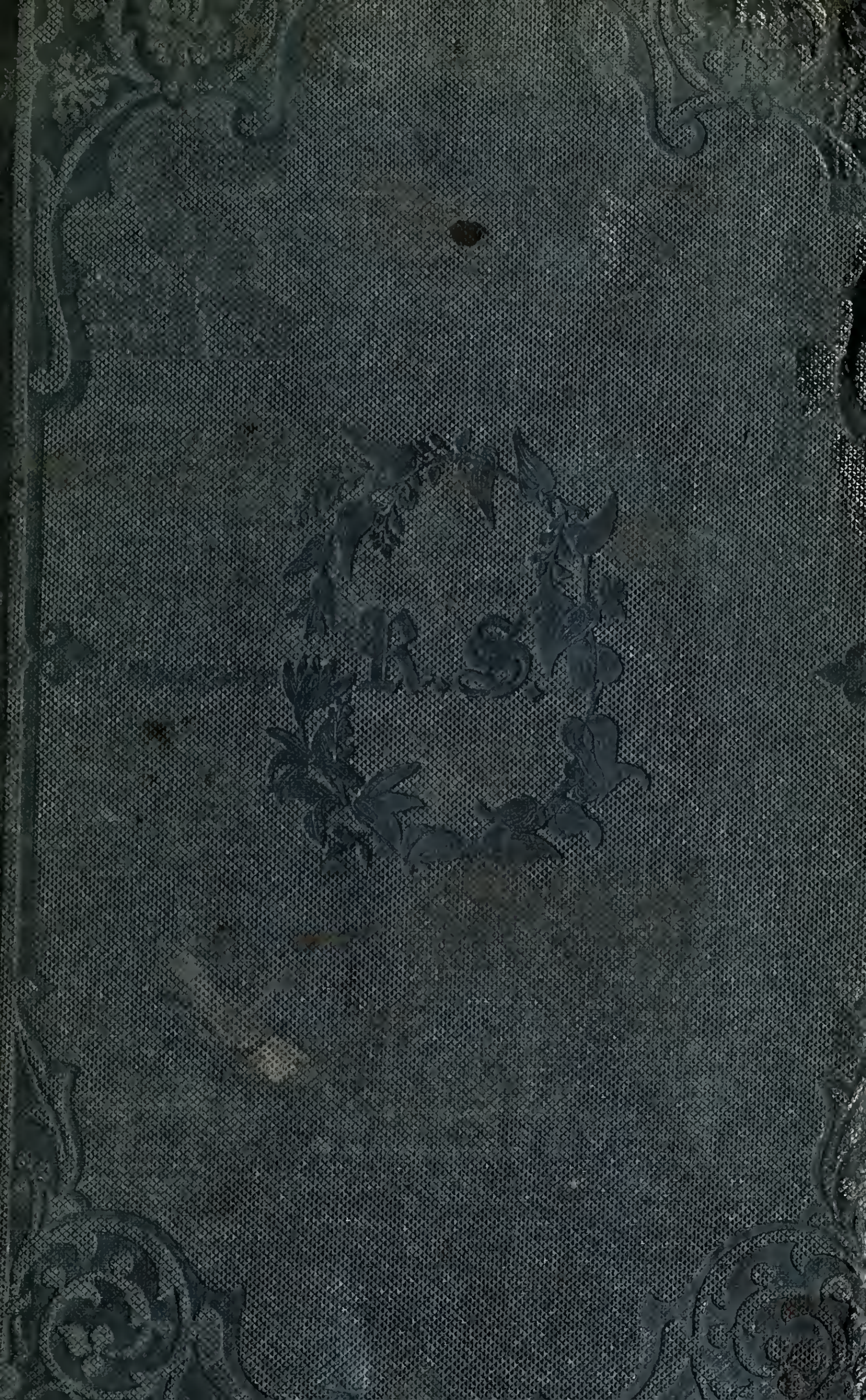
4
6
9
7
5
8
A
h
d
a
b
10
11
f
g

T. Wing lith

Reeve Benham & Reeve imp

1 2 3 CALIGUS JUNR.
4 5 ANCHORELLA UNCINATA ♂
6 7 LERNENTOMA CORNUTA ♂
8 LERNEOCERA JUNR.
9 LERNEOPODA ELONGATA ♂
10 LERNENTOMA LOPHII ♂
11 LERNEOPODA GALEI
A ANCHORELLA UNCINATA


R.S.